SCIENCE

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FRIDAY, JANUARY 24, 1896.

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MSS. intended for publication and books etc., intended for review should be sent to the responsible editor, Prof. J. McKeen Cattell, Garrison-on-Hudson, N. Y.

THE AMERICAN PHYSIOLOGICAL SOCIETY.

THE eighth annual meeting of the American Physiological Society was held in Philadelphia on December 27th and 28th, 1895. The meeting was preceded by the usual smoke talk upon the evening of December 26th. Three of the four formal sessions of the Society were held at the University of Pennsylvania, the fourth in the physiological laboratory of the Jefferson Medical College.

The following communications were presented and discussed:

1. R. H. CHITTENDEN: *The mucin of the white fibrous connective tissue.*

The mucin was prepared from ox-tendons by various methods, more or less analogous to those employed by Loebisch, but the products were all characterized by a comparatively high content of sulphur (2.30 per cent.), whereas tendon-mucin has heretofore been considered as having a low content of this element (0.81 per cent). The various results attained point to the probability that white fibrous tissue contains two or more mucins, closely related in general properties and reactions, but dissimilar in composition, owing possibly to variations in the proportion of proteid and carbohydrate radicles entering into the compound. In the several products analyzed, however, the percentage of sulphur was constant, the variability being confined to the carbon and nitrogen.

Especially important were the results obtained on cleavage of the mucin with boiling dilute acid (HCl). The presence of a true carbohydrate group was plainly shown by obtaining a well defined and crystalline osazone by the phenylhydrazine test. The osazone so obtained crystallizes in fine yellow needles usually arranged in rosettes. When purified as much as possible the osazone is readily soluble in warm water, alcohol, ether, chloroform and benzol. It melts at 158°–160°C., and appears to resemble very closely the pentaglucosazone obtained by Hammarsten from the cleavage product of the peculiar gluconucleoproteid described by him as present in the pancreas.

2. A. R. Cushny: *The distribution of iron in the Invertebrates.*

While the accumulation of iron in the Vertebrates is generally supposed to be a provision for supplying iron to the blood, such an explanation will not hold for the large percentage of iron in the hepato-pancreas of the Invertebrates, since in the latter the blood contains only traces of iron. The hepato-pancreas of the Crustacea and the Echinodermata shows about the same proportion of iron as the Mammalian liver, while the Mollusca have a much larger accumulation than either. Muscle seems to contain about the same percentage of iron throughout the animal kingdom, and in organisms without hepatic tissues, such as the Actinia, the percentage seems to approximate that of muscle.

3. J. J. Abel: *A preliminary account of the chemical properties of the pigment of the negro's skin.* (With W. S. Davis.)

This pigment is of importance, not alone because it is a distinguishing characteristic of the great majority of the human race and because it may be found to serve a physiological purpose, but also because of its very probable relationship to the pigment more sparingly deposited in the skin of the so-called white races and to that found in the hair.

It may also be found related to the pigment of the skin in certain pathological conditions, as in the bronzed skin of Addison's disease, or in the brown or black patches known as *naevi spili.*

The authors have succeeded in isolating the coloring principle of the negro's skin and they hope to apply their method to other instances of skin pigmentation. The isolated pigment has not yet been obtained entirely free of mineral constituents. After incineration the resulting ash consists mainly of silicon dioxide; a very little iron, amounting to 0.1% or less of the original weight of substance, is also present.

At present the authors are attempting to determine the composition of the pigment granules, the minute anatomical elements found in the lower epidermal cells which contain the pigment in union with other substances. While as yet unprepared to give quantitative results, they are convinced that these black granules contain very much inorganic matter, iron being present in considerable amount.

The isolated pigment is found to be very resistant toward destructive chemical agents. Freshly precipitated it is soluble in water, in alcohol (90%) and in mixtures of alcohol and ether. In its behavior toward mineral acids, alkalis and the agents employed to precipitate proteids and also toward oxidizing agents, it agrees with the dark pigments that have been obtained from the hair, from the choroid coat of the eye and from melanotic tumors; in short, it must be grouped with that ill-defined class of compounds known as melanins.

The pigment contained in the hair of the negro was also isolated and was found to respond in a like manner to the many chemical tests to which it was subjected. Ultimate analyses of the skin and the hair pigments also showed a close agreement.

Since the recorded analyses of the pigment of the dark hair of the white races show many points in common with those of the negro's skin and hair, it would seem very probable that the pigment of the negro's skin is closely related to that found in the hair of the white races.

The percentages of carbon, hydrogen, nitrogen, sulphur and oxygen found in the isolated pigment are far from supporting the theory that it is derived from the coloring principle of the blood.

Dry distillation of the pigment carried on at a certain temperature yields much pyrrol, a fact of special interest, since pyrrol has also been obtained from derivatives of chlorophyll and hæmoglobin and from certain melanins and proteids. While we are not justified at present in classifying the various pigments referred to as pyrrol derivatives, the presence of this chemical among their decomposition products would suggest a closer chemical union between chlorophyll and some of the animal pigments named than has hitherto been thought to exist.

4. T. B. ALDRICH: *On the chemical and physiological properties of the fluid secreted by the anal glands of Mephitis mephitica.*

The secretion, at least when examined a few hours after removal from the sacs, has a neutral reaction, a specific gravity, at ordinary temperatures, less than water, a golden yellow color, and a very well-known characteristic and penetrating odor. It burns with a luminous flame, giving off sulphur dioxide fumes, and gives all of the mercaptan and some of the alkylsulphide reactions.

By distillation the secretion is separated into two sharply defined, nearly equal portions: *A*, boiling between 100° and 130° C., and having the odor of the secretion; *B*, boiling over 130° C., and having a less offensive odor than *A*. *A* gives all the mercaptan and some of the alkylsulphide reactions; *B* does not react with either lead acetate or mercuric oxide, but gives some of the alkylsulphide reactions. In *A* we have one or more of the higher mercaptans, in *B* we have probably some alkylsulphides.

The fractional distillation of *A* gave three portions: *C*, B. P. 100–110° C.; *D*, B. P. 110–120° C., and *E*, B. P. over 120° C. *C* constitutes about one-half of *A*; the three fractions gave all the mercaptan reactions.

For the purpose of identifying the mercaptans in fraction *C*, several sulphur determinations were made; the lead and mercury compounds were made and subjected also to analysis. These analyses gave results which point to the presence of one of the butylmercaptans.

It is found that one is able to recognize with the nose $\frac{1}{6\,9\,0\,0\,0\,0\,0\,0\,0}$ mg of *C*; showing that it is this part of the original secretion which gives it its great penetrating and diffusing property.

The secretion is a powerful anæsthetic. There is an instance on record illustrating this property. Some years ago a number of boys caused one of their companions to inhale an unknown quantity of the secretion. The victim lost consciousness, but recovered under the care of a physician and showed no after-effects. The fluid also has the properties of a local irritant, *e. g.*, a drop in the eye setting up a conjunctivitis. Those that have worked with the secretion and have inhaled much of the vapor complain of violent headaches and dysuria. The present writer has not observed these symptoms in himself, although he has worked with comparatively large quantities of the secretion for a long time.

Further chemical and physiological experiments are now in progress.

5. G. LUSK: *Phloridzin diabetes and the maximum of sugar from proteid.*

It was shown that after administration

to fasting rabbits of small doses (1-2 grms.) of phloridzin at frequent intervals (8-12 hours) sugar appeared in large quantity in the urine of the first twenty-four hours, representing a proportion of dextrose to nitrogen in the urine as high as 5.4 is to 1, or D: N:: 5.4:1. In the urine of the second twenty-four hours the relation, however, approximated that found by Minkowski in fasting dogs after extirpation of the pancreas *i. e.*, D:N:: 2.8:1. The action of phloridzin in fasting rabbits is to sweep the organization free from sugar, and thereafter to remove such sugar as may be formed from proteid. Calculation shows that the 45.08 grms. of dextrose produced from the oxidation of 100 grms. of proteid in tissue metabolism contain 44.4% of the available energy in the proteid (using Rübner's estimate that 1 grm. of proteid yields 4000 Cal. in the body.)

6. W. T. Porter: *Further researches on the coronary arteries.*

The frequency with which arrest follows closure of one of the large coronary branches depends on the size of the artery ligated and on the irritability of the heart at the time the ligation is made. The consequences of closing a sufficiently large branch are a fall of the intracardiac pressure during systole, a rise during diastole, a fall in the quantity of blood discharged from the left ventricle, and finally arrest with fibrillary contractions. These consequences are not the result of the mechanical injury done the heart in the operation of ligation. Severe crushing of the cardiac tissue near the coronary arteries rarely produces the phenomena in question. Nor were they once seen in nearly one hundred preparations of the arteries for ligation. Further, the phenomena described can all be produced by closure of the coronary arteries without mechanical injury. This may be accomplished by plugging the mouth of the left coronary artery with a glass rod passed into the aorta through the subclavian or innominate arteries. It can also be done by closing the arch of the aorta for a few seconds, injecting into the aorta at the same time a quantity of lycopodium mixed with defibrinated blood. The lycopodium enters the coronary arteries and closes their smaller branches by embolism. The changes in intracardiac pressure and the arrest with fibrillary contractions are therefore not due to mechanical injury of the heart. They must then be a consequence of the sudden anæmia of the heart muscle caused by closing the arteries that supply it. There is no fundamental difference between the uncoördinated contractions seen in the heart after its arrest from hemmorrhage, as after opening the large arteries, and the fibrillary contractions brought on by closure of a coronary artery.

7. G. N. Stewart: *Note on the quantity of blood in the lesser circulation.*

8. C. F. Hodge: *Histological characters of lymph as distinguished from protoplasm.*

The ordinary histological analysis of an organ includes the cells characteristic of it, the connective tissue supporting structures, its blood vessels and lymphatics, and its nervous supply. In addition to the above, lymph is continually streaming through the cells and between them. We know that this lymph contains large quantities of proteid matter in solution which is precipitated by the ordinary reagents used in hardening tissues for microscopical purposes. If this precipitate is wholly inert toward staining reagents, we are not even then justified in leaving it out of our histological analysis, since many structures of the greatest importance are 'achromatic.' If lymph precipitate or coagulum does stain, it is clearly of importance to determine what form it takes in the section, granular, reticular or alveolar.

The first method employed consisted in smearing frog's lymph on a slide, plunging it into mercuric solution and passing it through different stains. Such films gave a granulo-reticular appearance strongly stained and quite similar to many ordinary cell protoplasms. The absence of any control as to thickness of film, however, makes this method inapplicable to rigid comparison with appearances of protoplasm in sections of known thickness. In order to meet this difficulty, although possibly introducing others, the author inserted small bits of dry pith into the lymph sac of a frog, and after these had become saturated with lymph they were removed and with similar sized bits of other tissues were passed through various histological processes and sectioned in paraffin. Thus sections of tissue and of lymph coagulum, filtered through the walls of pith cells, were obtained, of equal thickness and comparable in every way.

Compared thus with cells of nerve, muscle and gland the chief result is that lymph furnishes to empty pith cells a histological content strikingly similar to certain structures usually ascribed to protoplasm. Recently Fischer, by injecting pith with chemically prepared solutions of proteids, peptones, *et al.*, proved that a number of reagents precipitated these proteids in the form of granules not to be distinguished from Altman's 'Elementarorganismen.' It thus becomes manifest that the granular factor in cell protoplasm may be readily accounted for as a simple artefact formed from solutions and not necessarily as preformed in the cell. In the author's experiments on lymph in which osmic acid, Flemming's solution, mercuric chloride, gold chloride and alcohol were used for hardening, the character of the precipitate was chiefly reticular or alveolar. In alcohol and mercuric chloride this is fine and appears under ordinary powers as vacuolated granular protoplasm. In osmic solutions it is coarsely alveolar with dense accretions of stained matter at the angles of the alveoli. Gold chloride gives a striking fibrillar reticulum with frequent sharply defined granules, resembling the varicosities and end balls often described in connection with nerve fibrils.

A number of stains have been tried. The carmines and hæmatoxylins are strongly retained, as are most of the anilins, eosin, fuchsin and nigrosin, and even methyl blue and safranin are retained quite strongly. Comparison with cells of different tissues prepared side by side with the lymph from the same frog would thus indicate that a considerable proportion of the substance stained in the cell protoplasm can not be differentiated from lymph by the stains thus far employed. It is true that identity of staining cannot be taken to prove identity of substance; but until other methods of analysis prove either identity or difference, we must admit the possibility that a large factor in what is ordinarily described as the granulation or reticulation of cell protoplasm may be simply precipitate in the cell of lymph common to the whole body. Until such analysis is made, further work upon the finer 'structure' or even on the 'content' of the so-called 'protoplasm' can have little permanent value. A point of special importance is that the nucleus stains by almost all methods in a way to differentiate it sharply from lymph precipitate. These reactions would disprove all ideas tending to make the nucleus a lymph space in the cell.

9. C. F. HODGE (for J. R. Slonaker): *Demonstration of the comparative anatomy of the area and fovea centralis.*

Methods for preserving the eye and for the demonstration of the retina in the eye as a whole and in microscopical sections were briefly discussed and a large number

of specimens were exhibited. The general summary of the forms thus far studied may be made as follows:

Mammals possess an area as a rule; in some, however, notably the dog, no area can be distinguished. The primates are the only class in which a fovea is present.

All birds examined, except the chicken, have one or two well-defined foveas with areas of various forms. In the domestic chicken no trace of fovea or area has been observed. Both the quail and partridge have well-developed foveas. Among the birds studied, the following have a central fovea with circular area: turkey, duck, partridge, quail, pigeon, song and English sparrow, kinglet, robin, bluebird, and crow. The goose and ring-neck plover possess a central fovea and a band-like area. In the tern we find two foveas and a band-like area extending horizontally across the retina. One of the foveas, corresponding in position to the human fovea (nasal) is situated near the optical axis and within the area. The other fovea (temoral) is located above the band-like area and close to the *ora serrata*. Its position would indicate that it serves for binocular vision. Both the sparrow hawk and the red-tailed buzzard hawk possess two foveas, each one surrounded by a well-defined circular area and connected by a slightly developed band-like area. The foveæ in the hawks are much closer together than in the tern and are both comparatively near the optical axis, the temporal fovea apparently moving towards the center of the eye as the position of the eye in the socket changes from the lateral to the frontal type. The kingfisher resembles the hawks in the above particulars.

As to the reptiles, amphibia and fishes, the turtle and frog have band-like areas extending across the eye horizontally just above the nerve. These are not marked by any thickening of the retina, but by a closer packing together of the cells, especially well seen in the ganglion cell layer. In none of the fishes examined has either area or fovea been found. The retina is, however, much thickened over the superior half.

10. G. C. Huber: *The ending of the chorda tympani in the sublingual and the submaxillary glands (with demonstrations).*

The observations reported were made on preparations obtained from young dogs and puppies; the tissues were stained with the double Golgi-Cajal method and the Ehrlich-Bethe methylene blue method. The following conclusions were reached:

1. The cells of the sublingual and the submaxillary ganglia are multipolar in type; they belong to the sympathetic system; this is shown in preparations impregnated with chrome silver.

2. The axis cylinders of the sympathetic cells follow the larger and smaller gland ducts and form a plexus about the intralobular ducts. From this plexus fibres are given off that form a second plexus about the alveoli outside of the *membrana propria*. From this second plexus ultimate fibrillæ pass off, penetrate the *membrana propria* and end on the gland cells.

3. The chorda tympani consists of fibres, some of which end in the form of a pericellular end-basket around the cells of the sublingual ganglion, while others have no connection with this ganglion, but end in a similar manner in the submaxillary ganglion. No fibers of the chorda tympani end on the gland cells.

4. The sympathetic fibres following the branches of the submaxillary artery are axis cylinder branches of the sympathetic cells in the superior cervical ganglion. As far as has been determined, they end on the blood vessels.

11. G. W. Fitz: *A working model of the eye.*

Dr. Fitz showed a working model of the eye consisting of a skeleton eye set in gym-

bals to allow for free motion in vertical and horizontal planes. The front of the eye carries an elastic lens, made by fastening a sheet of gelatine over a water chamber with a glass back. The gelatine is bulged more or less, as the water pressure in the chamber is increased or diminished by raising or lowering the reservoir connected with it by rubber tubing. A portion of the retina is represented, including the yellow and blind spots and serves the purpose of a screen for receiving the images of candles used with the model for studying the optics of vision.

The optical conditions involved in normal vision, accommodation to near and far objects, the use of the iris, near and far sight and correction by lenses, the blind spot, corresponding points of retinæ (two models), binocular vision and convergence, estimation of distance, Scheiner's experiment, etc., may be experimentally studied with the model.

12. J. G. CURTIS: *A method of recording muscle curves.*

Dr. Curtis briefly referred to a method of recording muscle curves so that they shall be visible to a large lecture class, such as commonly calls for the use of the duBois 'muscle telegraph.'

The shaft of a muscle lever of Tigerstedt's form is replaced by a stout and very long straw which shall magnify the contractions as much as possible. In a cleft in the free end of this straw is stuck a piece of leather, which is to 'write' upon a drum turned simply by hand. The leather should be about $2\frac{1}{2}$ centimetres long, and 8 to 10 millimetres wide, the length of the leather lying in the length of the straw. The leather should be flexible, but thick enough to be moderately elastic; its rough side should be turned toward the drum, and longitudinal cuts, each about 6 to 8 millimetres deep, should be made with scissors in its free end, so as to divide what is to answer to a 'writing point' into five or six fingers.

The straw lever should be placed normal to the drum and pushed directly toward the latter until the cloven end of the leather not only touches the drum, but is deflected rather sharply in the direction toward which the latter is to revolve.

If now the drum be made to revolve by hand, there may be recorded very sufficient muscle curves, each made up of several neighboring parallel lines, which lines are visible together at a distance as a white band from 4 to 10 millimetres wide.

13. G. N. STEWART: *Measurements of the circulation time of the retina.*

Dr. Stewart demonstrated for the particular case of the retina a method of measuring the circulation time employed by him for various vascular tracts. A solution of methylene blue in normal saline was injected into the central end of one jugular vein of a rabbit. The retina on the other side was observed with the ophthalmoscope, and the interval between the appearance of the blue in the central artery and in the central vein measured with the stop-watch. The following is a specimen experiment:

Rabbit, 1360 grms, in weight.

Circulation time from central artery to central vein of retina, 1.75, 1.8, 1.7, 1.95 seconds. Last seen to be rather too long.

Circulation time from jugular vein to retinal artery, 4.05 seconds.

Circulation time from jugular vein to carotid artery, 2.8 seconds.

Circulation time from jugular vein to retinal artery, 3.8 seconds.

Circulation time from retinal artery to retinal vein, 1.8 seconds.

Circulation time from retinal artery to retinal vein, 1.85 seconds.

Circulation time from jugular vein to retinal artery, 4.0 seconds.

Circulation time from jugular vein to carotid artery, 2.25 seconds.

Circulation time from jugular vein to carotid artery, 2.5 seconds.

14. T. W. Mills: *Cortical cerebral localization in certain animals.*

The paper was a report on the above subject confined chiefly to birds and one rodent, the rabbit. The work will be extended to other rodents.

Birds: The author finds that stimulation of the cortex will not produce movements of the head in birds, as stated; that the effect on the pupil is not constant but variable; that it is not always confined to the opposite side, though it is usually most pronounced on that side; that there is one invariable effect of stimulating the cortex of birds, viz: drawing of the nictitating membrane over the eye ball to a greater or less extent, dependent upon the strength of the stimulus. This result is not mentioned by other investigators, and the author cannot confirm most of Ferrier's statements regarding the results of stimulating the cerebrum of the pigeon. His own experiments were made on fowls and pigeons, chiefly the latter, and on both pure-bred and common specimens.

Rabbit: As regards the rabbit, the author had been unable to find a cortical centre for the hind leg, though such a centre is clearly mapped out by Ferrier. He had no difficulty in all cases in getting cortical localization of movements of the head, mouth parts, fore limbs, etc., in the rabbits. He had used a great variety of animals of different ages, and both pure-bred and cross-bred animals.

In the dog, cat and all the animals the writer had examined, he was convinced that the definiteness of the limits of centres had been exaggerated and that probably new explanations of 'motor centres' would require to be constructed. Definiteness of localization is unquestionably found to increase, however, as one ascends the animal scale.

15. W. T. Porter: *A new method for the study of the intracardiac pressure curve.*

Two methods are now used to record the changes of pressure in the heart. In one the manometer and the tube connecting it with the heart are filled with liquid, to the exclusion of air; in the other the distal portion of the tube contains air. In the former method the advantage gained by employing an incompressible fluid is diminished by the inertia introduced by the weight of the liquid column. In the latter the lessening of inertia by substituting air for water in a part of the tube is more than offset by the loss of time unavoidable in the registration of very rapid changes of pressure by a compressible medium. The errors inherent in these two methods explain the many opposing opinions regarding the form of the intracardiac pressure curve and the filling and emptying of the heart. A theoretically perfect method requires the use of an incompressible fluid and an absence of inertia. In the new method offered by Dr. Porter these conditions are both fulfilled.

A stopcock worked by an electro-magnet is placed in the tube connecting the ventricle with the manometer that is to write the pressure curve. The current which opens the stopcock is made by a second manometer, also connected with the ventricle, driving a wire, fastened on its lever, into two mercury cups, as the pressure in the ventricle rises. By adjusting the wire the circuit can be made at any point in systole. If made near the summit of contraction the stopcock will be opened only during the maximum of ventricular contraction, and the manometer will write only the top of the intraventricular curve, for example, the last twentieth of the rise in pressure. The inertia error caused by the liquid in the manometer and the connecting tube passing through one-twentieth its usual rise is so slight as practically to disappear. The true summit of the intraventricular curve is thus secured, free of inertia error. This summit is seen

to be a straight line, parallel or nearly parallel with the atmospheric abscissa.

16. S. J. MELTZER: *On the mode of absorption from the peritoneal cavity in rabbits.* (With I. Adler.)

In the recent literature on the physiology of absorption a number of writers have expressed the surprising opinion that the lymphatics assist but little in the absorption from the serous cavities. With regard to this question Meltzer and Adler made two sets of experiments on rabbits. In the first set 100 cc. of a saline solution were introduced into the peritoneal cavity (the animals were always well narcotized), and removed again after 40 minutes. In order to exclude the lymphatics, in some rabbits the innominate veins were ligated. While in a large number of normal rabbits the quantity absorbed in 40 minutes was about 35 cc.; in those with ligated lymphatic ducts it was about 18 to 12 cc. The authors, however, avoid drawing the conclusion from these experiments that the lymphatics are of great importance to the absorption, since some normal rabbits showed poor absorption, and, in fact, in two cases more fluid was taken out than was put in. In the other set of experiments for each rabbit with ligated innominate veins a control rabbit was taken, whose external jugular veins were ligated. Both animals were alike in regard to the venous stasis of their brains, but differed as to their lymphatics; in one they were excluded, and in the other they were not. The same dose of strychnine was injected into the abdominal cavity of each; the one with the lymphatics open had a tetanic attack, the other was attacked either not at all or much later. The same was seen when about 1.5 cc. of 5 % potassium ferrocyanide was injected, and the urine was tested. The Prussian blue reaction appeared in the rabbit with ligated lymphatics, an hour or an hour and a half later than in the rabbit with open lymphatics. This shows distinctly what importance the lymphatics have for the absorption from the peritoneal cavity.

17. S. J. MELTZER: *On the incorrectness of the often quoted experiments of Starling and Tubby with reference to the mode of absorption from the peritoneal cavity in dogs.*

As an important argument for the theory that the fluid from the peritoneal cavity enters the circulation directly through the walls of the blood vessels and not by the long way of the lymphatics, the experiments of Starling and Tubby are often quoted. Starling and Tubby have made only three experiments, and have published one protocol only, which is in the main as follows: 40 cc. of indigo carmine were introduced into the abdominal cavity; 2 minutes after the injection the urine was dark blue, while a half hour later the lymph showed a bluish tinge. Meltzer has repeated these experiments and found quite a different result. Potassium ferrocyanide or indigo carmine appeared in the lymph from the thoracic duct about 14 minutes after their introduction into the peritoneal cavity, but in the urine only after an hour or more. Moreover, even after the injection of indigo carmine directly into the circulation, 23 minutes elapsed before the urine became blue.

18. F. S. LOCKE: *On the action of ether on contracture and on positive kathodic polarization of voluntary muscle.*

Mr. Locke described experiments, the graphic records of which were shown, in which the action of ether on striated muscle under the influence of various contracture-conditioning agents was investigated. Under etherization the normal twitch of short duration reappears. The relation of this result to Biedermann's positive kathodic polarization of striated muscle was

pointed out, reasons for considering which undemonstrated were given.

19. H. G. Beyer: *On the influence of exercise on growth.*

Dr. Beyer spoke of the necessity of applying more exact methods of investigation to the study of this very important physiological subject than had been done hitherto. While acknowledging that some of the more general good effects of all forms of exercise were within the easy reach and the experience of all, the more remote and permanent ones must be made the subject of more serious study and investigation.

He described one of the methods by means of which the influence of systematic gymnastic or of other forms of exercise might be ascertained, and presented the results of some investigations in this direction. For example, as to height, his figures presented strong evidence that height is decidedly increased by exercise taken within physiological limits and during the period of growth.

20. W. H. Howell (for Messrs. Conant and Clark): *The existence of a separate inhibitory and accelerator nerve to the crab's heart.*

The work was done upon the common edible crab, *Callinectes hastatus*. The authors have been able to show that two separate nerves pass from the thoracic ganglion to end in a plexus in the wall of the pericardium and that one of these nerves, when stimulated, inhibits the heart beat, while the other causes marked acceleration. The inhibiting nerve was traced anatomically to the ganglion, which it joins in company with the large mandibular nerve. The junction of the accelerator nerve with the ganglion has not so far been demonstrated anatomically, but the physiological evidence indicates that it leaves the ganglion in company with the nerve to the first pereiopod. If this latter nerve is severed from the ganglion, stimulation of the ganglion no longer gives acceleration. If the peripheral end of the severed nerve, however, is stimulated, marked acceleration is obtained. If, moreover, the severed nerve is again cut a little farther to the periphery, stimulation of the new peripheral end no longer affects the heart, while stimulation of the small isolated piece thus obtained gives acceleration. This evidence indicates that the accelerator nerve leaves the nerve of the first pereiopod a short distance, about 1 centimetre, beyond the thoracic ganglion. As stated above, in the neighborhood of the pericardial plexus it is easily found as a separate nerve lying close to the inhibitory nerve. The authors were not able to obtain any evidence of a tonic activity of either of these nerves. Stimulation of the cerebral ganglion with strong currents gave inhibition of the heart, which disappeared, however, when the commissures connecting this ganglion with the thoracic ganglion were cut.

21. Fr. Pfaff: *On toxicodendrol and on the so-called toxicodendric acid.*

'Toxicodendric acid' has been regarded heretofore as the active principle of poison ivy, *Rhus toxicodendron*. Dr. Pfaff isolated this acid and analyzed its barium and sodium salts. Quantitative and qualitative tests show that it is really nothing but acetic acid. The true active principle of poison ivy is an oil named by Dr. Pfaff *Toxicodendrol*. The purity of the oil obtained was proved by quantitative analyses of the lead compounds with different preparations of the oil.

22. H. C. Chapman: *Methods of teaching physiology.*

Professor Chapman gave a demonstrative talk upon methods employed in his own teaching, illustrating his remarks largely by apparatus devised by himself. He urged the value of the comparative method and

showed a valuable series of Mammalian brains, together with other comparative anatomical preparations.

The following new members were elected:

J. G. Adami, M. A., M. D., M. R. C. S., Professor of Pathology, McGill University.

T. B. Aldrich, M. D., Instructor in Physiological Chemistry, Johns Hopkins University.

J. McK. Cattell, Ph. D., Professor of Experimental Psychology, Columbia College.

G. P. Clark, M. D., Professor of Physiology, Syracuse University.

R. H. Cunningham, M. D., Assistant Demonstrator of Physiology, College of Physicians and Surgeons, Columbia College.

G. W. Fitz, M. D., Assistant Professor of Physiology and Hygiene, Harvard University.

T. Hough, Ph. D., Assistant Professor of Physiology, Massachusetts Institute of Technology.

R. Hunt, A. B., Fellow in Physiology, Johns Hopkins University.

F. S. Locke, M. A., M. B., Instructor in Physiology, Harvard Medical School.

Professors C. S. Minot and C. F. Hodge were appointed to express to Prof. Langley the opinion of the Society that it is highly desirable that the table of the Smithsonian Institution at the Naples Zoölogical Station be continued. Mr. W. B. Saunders entertained the members of the Society at luncheon at the Art Club. The Society enjoyed also the courtesies that were extended to the affiliated societies by the University of Pennsylvania and the Philadelphia Local Committee.

Officers for the coming year were elected as follows: Members of the Council, H. P. Bowditch, R. H. Chittenden, W. H. Howell, F. S. Lee, J. W. Warren; President, R. H. Chittenden; Secretary and Treasurer, F. S. Lee.

The President and the Secretary were appointed respectively Delegate and Alternate to the Congress of American Physicians and Surgeons of 1897.

FREDERIC S. LEE,
Secretary.

THE PHILADELPHIA MEETING OF THE AMERICAN PSYCHOLOGICAL ASSOCIATION.

AT the Princeton meeting of the Association a year ago overtures of affiliation were received from the American Society of Naturalists, and in response to these the meeting of 1895 was held at the same time and place as those of the affiliated societies. The opportunities thus afforded of seeing and hearing distinguished representatives of kindred lines of investigation added much to the interest of the psychological program, while the abundant hospitality of the local committee provided for the social contact, which is rightly an important feature of all such gatherings.

On opening the first session of the Association, the President, Prof. Cattell, of Columbia, introduced Prof. Fullerton, Dean of the University of Pennsylvania, who first welcomed the Association to the University and then read a paper on *Psychology and Physiology*. In it he drew the boundary between the two sciences sharp, not with any view to warning off mutual trespass, but to having the writers of text-books keep clear for their readers the essential limits of both sciences. With Foster's Physiology as a text Prof. Fullerton showed what lavish use is made in the chapters on the functions of the sense organs and the nervous system of material that is patently psychological, *i. e.*, secured by the distinctly psychological method of introspection. This paper appears in full in the current number of the *Psychological Review*.

Prof. Fullerton was followed by Dr. Farrand, of Columbia, who described a *Series of Physical and Mental Tests on the Students of Columbia College*. The tests described are made on the undergraduates of the College

at entrance, and repeated upon the same students at the end of their Sophomore and Senior years. The object of the tests is to obtain a record for comparative purposes of certain mental and physical characteristics of the students at different times during a period of rather active intellectual growth, and at the same time to furnish material for a statistical study of the particular points examined. Stress is laid to a certain extent upon the more purely mental inquiries, such as memory, rate of perception, and motor response, accuracy of perception, color vision, etc., but enough physical tests are included to afford a comparison between bodily and mental development if any relation between the two exists. Dr. Farrand's paper led to a discussion of the advantages of such prolonged statistical inquiries, at the conclusion of which, on motion of Prof. Baldwin, of Princeton, the Association voted to appoint a committee to consider the matter of the coöperative collection of such data by the various psychological laboratories. This committee, as announced at the business meeting, is composed of Professors Baldwin, Jastrow, Sanford, Witmer and Cattell (chairman).

Dr. Arthur MacDonald's paper on *Some Psycho-Neural Data* was a report upon experiments similar to those reported on by the same speaker at the Princeton meeting (see Science, I., 43), but this time including, besides experiments upon pain, others on discriminative sensitivity of the skin (Weber's circles), and just observable differences in warmth. The experiments were regarded rather as tests of tests than as leading to definitive results, but they nevertheless appeared to indicate some interesting relations, of which the most general were the greater general sensitiveness of the left side as compared with the right, the greater sensitiveness to pain of women as compared with men, and the greater sensitiveness of young men of the wealthy classes both to differences in locality (Weber's circles), and to pain as compared with men in the Boston 'Army of the Unemployed.'

Mr. Oliver Cornman, the next speaker, reported upon *An Exprimental Investigation of the Processes of Ideation*, a study upon school children undertaken under the direction of Prof. Witmer. The children were asked to write as many words as possible in an interval of fifteen minutes, writing the words in columns. In general lists of from 200 to 400 words result, which are then classified and subjected to statistical treatment. It has been found that the directions given the children at starting are extremely important in determining the flow of associated words, and that the last third of the fifteen-minute period gives results most indicative of the individuality of the child. This investigation is understood to be still in progress.

The session of Friday afternoon was opened by the *Presidential Address* of Prof. Cattell, of Columbia College, who described the history and recent progress of psychology and the part played in its development by experiment and measurement. Psychology is by no means a new science, but its growth during the last few years has been rapid, and it now rivals the other leading sciences in productiveness of research and publication and in academic position. Science is either genetic or quantitative, and psychology is advancing in both directions. The problems that can be treated in the laboratory were reviewed, and it was claimed that these have added directly and indirectly new subject matter and methods, have set a higher standard of accuracy and objectivity, have made some part of the subject an applied science with useful applications, and have enlarged the field and improved the methods of teaching psychology. In conclusion, the relations of psychology to the other sciences and to philosophy were reviewed and their interdepen-

dence was emphasized. The address will be printed in the March number of *The Psychological Review*.

The President's address was followed by an informal communication from Prof. Ladd, of Yale, upon the *Direct Control of the Retinal Light*. After a description of the phenomenon (upon which the speaker has contributed a brief paper to the *Psychological Review*, I., 351) a syllabus of simple experiments for observing it was distributed and coöperative aid in its study solicited.

The next speaker was Prof. Strong, and his topic *Consciousness and Time*. The paper was a critique of the views presented in the Presidential address of Prof. James at the Princeton meeting. It was then argued that the perception of passing time involved a successive unity of consciousness in addition to the simultaneous unity required for the perception of likeness and difference. Prof. Strong, on the contrary, held that a successive unity is an impossibility, and that the consciousness of succession being in its nature retrospective, all knowledge of passing time must be representative, thus making the ordinary simultaneous unity of consciousness all sufficient. This paper will appear in the *Psychological Review*.

The afternoon session concluded with the paper of Brother Chrysostom on *Some Conditions of Will Development*. These conditions, the speaker considered, fall under two heads: the instrinsic, or such as depend on the voluntary agent, and the extrinsic, or such as act on him from without. The first of the intrinsic conditions is the nature of the will itself, which is indeterminate, at least as to the means that it shall employ. Objection to this view based on 'Double Consciousness' does not hold. The will is, however, determined to a certain extent by habit and intellect, and heredity and environment exercise a marked influence upon it. Environment itself, however, is partly subject to will and herein lies the great opportunity of ethical improvement.

The paper of Prof. Lloyd, of the University of Michigan, on *A Psychological Interpretation of the Rules of Definition in Logic*, though in the hands of the Secretary, was omitted because of the fulness of the program.

The most generally interesting and the most fully attended session of the Association was that of Saturday morning, when a discussion on *Evolution and Consciousness* brought together as participants Professors James, Cope, Baldwin, Minot and Ladd. Prof. James in opening the discussion sketched in brief the several aspects of the general question upon which psychological interest is more or less centered.

1. How ancient is consciousness in the world at large? To this question Clifford, Fechner and others have replied with a doctrine of atomic souls, making consciousness coeval with the universe, while Spencer and others again have advanced theories which place its entrance relatively late in cosmic development. The monadism of Leibnitz and the current doctrines of the soul are still other coödinate theories. 2. Is consciousness a genuine dynamic agent in the psycho-physical combination or merely an epiphenomenon? Here, it was said, the leaning of all the younger workers and of some of the elder is toward automatism, or psycho-physic parallelism, though others of the elder men still contend for a genuine effect of mind upon its bodily partner. 3. In the field of individual consciousness the question is that of nativism and empiricism; what in the consciousness of the child, for example, is inherited and what is acquired? Here the balance of current opinion dips heavily toward nativism.

Prof. Cope, of the University of Pennsylvania, who followed, spoke from the platform of zoölogical evolution. In these mat-

ters the point of view is all important. Darwin was an œcologist, Weismann and the Neo-Darwinians are mostly embryologists and their views are influenced thereby. The real history of evolution, however, the facts apart from any speculation about them, lies in the field of the paleontologist, and by him such questions must be settled.

After rapidly outlining the position of the Neo-Darwinians, the speaker indicated the sort of evidence that had led him to the opposite view. With regard to consciousness he remarked that the only systems in man that were abreast of evolutionary advance were the nervous system (the physical representative of consciousness) and the reproductive system; the rest is that of the eocene mammals. The course of evolution has, on the whole, been upward and purposeful. For this, physical and chemical forces cannot account, nor can theories of chance variation which make consciousness useless; consciousness itself has been an active participant. In the individual—at least in the representative activities of mind—consciousness may be conceived to affect the qualitative relations of the physical energy used, though not the quantitative relations. In the presentative activities, on the contrary, both are physically determined. The control in representative thinking is sufficient to make consciousness a real dynamic agent.

The next speaker was Prof. Baldwin, of Princeton, who, while concurring in the main with the previous speaker, deprecated the conception of mind as an extraneous something thrust in from without, and advocated the standpoint of monism.

Prof. Minot, of the Harvard Medical School, spoke for the Neo-Darwinians and embryologists. Admitting the facts that had been advanced by Prof. Cope in favor of the Neo-Lamarckian position, the speaker found himself unable to accept the inferences drawn from them, and totally unable to conceive how the experiences of the adult can in any way be communicated to the embryo, the development of which he was forced to look upon as regulated by purely mechanical causes. With regard to life itself, however, the tendency of present biological thought is away from purely mechanical views; living and non-living matter are not the same thing. Consciousness is coextensive with life. While it does not break into the stream of physical energy, it selects among the possible transformations of that energy and thus has its effect without being itself any form of energy.

Prof. Ladd's position was that of an unequivocal idealist. He denied that consciousness in the world or in the individual could in any way be derived from a combination or modification of physical things. The very concepts of physics, energy and the like, can be derived from consciousness alone and have no meaning apart from it. Consciousness plays an active part in the psycho-physical partnership, and the struggle for existence is a psychical struggle. He reminded psychologists further that even the physicist's cardinal principle of the conservation of energy is yet far from demonstrated for cerebral action, or even for the action of the simple nerve-muscle machine, and ventured the prediction that that principle would undergo modification at the hands of the physical scientists themselves.

The question was then thrown open for general discussion, in which Professors Fullerton, Hyslop, Strong, Miller and Mills took part; and the whole was finally concluded by brief rejoinders from several of the original speakers.

At the afternoon session on Saturday, Prof. Patrick, of the University of Iowa, reported on *An Experiment on the Effects of Loss of Sleep*. The subject of this experi-

ment, a healthy young man, was kept without sleep for ninety successive hours. Every six hours elaborate physical and mental tests were made upon him, and at the end of the ninety hours the depth of his sleep was tested every hour through the ten and a half that he continued to sleep.

During the ninety hours of waking, the subject gained slightly in weight, though his only additional food was a light lunch taken just after midnight, but lost even more during the period of sleep that followed. The results of the tests may be briefly summarized as follows: The loss of sleep appeared to cause little loss of general mental activity; sharpness of vision, discrimination of taste sensations and possibly rapidity in reaction-times involving discrimination increased. Simple reactions, the pulse rate and the adding of figures were somewhat slowed. Muscular power was also somewhat lowered. In several of these, however, the expectation of the end of the test caused a return to near the normal during the last half day. Hallucinations of vision, due probably to the unusually prolonged stimulation of the eyes, were observed. The shortness of the period of sleep required for entire recovery gives ground for the belief that sleep is a relative matter, and that, in spite of being kept as fully awake as a man could be, the subject nevertheless was more or less of the time in a state of partial somnolence.

The second paper was a brief report by Prof. Mills, of McGill University, on *Further Researches on the Psychic Development of Young Animals and its Physical Correlation.* His researches upon pure-bred dogs reported last year have now been extended to mongrel dogs, the cat, rabbit, guinea pig and birds, and their results will soon be published. The mass of details involved prevented more than an annoucement of the work accomplished.

Prof. Witmer's paper on *Variations in the Patellar Reflex as an Aid to Mental Analysis* was next read. It contained an account of a long and elaborate study of the knee-jerk and its variations as a preliminary to its use as an index of psychical activity in studies of emotion. The varied details of the paper forbid brief presentation; certain bilateral forms of experiment, however, may be mentioned as of especial interest.

The fourth paper was that of Prof. Hyslop, of Columbia, entitled *Experiments on Induced Hallucinations.* In it were reported with critical comment a considerable set of observations by a lady of Prof. Hyslop's acquaintance, on hallucinations secured by the method of 'crystal vision.' Few or none could be traced by the observer to actual experiences, but some may have had that origin. Two or three would lend themselves to a telepathic explanation, but are by no means definite enough to have any confirmatory force in favor of such a theory. Perhaps the greatest interest in such hallucinations is the possible light which their examination may throw upon normal mental action.

The closing paper of the session was by Prof. Newbold, of the University of Pennsylvania, on *Dream Reasoning.* Three cases were described, one where the subject-matter was mathematical, one in which it was linguistic, and one in which it was archeological, the last two coming from the experience of a single person. In all three the dream reasoning lead to results that were valuable in waking life.

At the regular business meeting held after the discussion Saturday morning the following officers were elected: President, Prof. G. S. Fullerton, University of Pennsylvania; Secretary and Treasurer, Dr. Livingston Farrand, Columbia College; Members of Council, Profs. E. H. Griffin, Johns Hopkins University, and E. C. Sanford, Clark University.

The following gentlemen were elected

to membership: Prof. E. D. Cope, University of Pennsylvania; Prof. C. S. Minot, Harvard Medical School; Mr. J. E. Lough, Harvard; Dr. E. A. Singer, Harvard; Dr. N. Wilde, Columbia; Dr. C. H. Bliss, University of the City of New York; Dr. Franz Boas, New York; Mr. Warner Fite, Williams College; Prof. J. E. Creighton, Cornell; Dr. H. Austin Aikins, Western Reserve; Dr. W. G. Smith, Smith College.

The report of the Secretary and Treasurer showed a membership of sixty-five and a balance in the treasury of over $290. A vote of thanks for the hospitality received was unanimously passed. The fixing of the time and place of the next meeting was left in the hands of the incoming President in coöperation with the Presidents of the other Societies. It was voted that any members attending the meeting of the International Psychological Congress in Munich next summer should, on notification to the Secretary of the Association, be empowered to act as delegates from the Association.

Between the morning and the afternoon sessions on Saturday an informal meeting of those interested in the formation of a Philosophical Society, or the organization of a Philosophical section within the Psychological Association, was held, and at the afternoon meeting the matter was brought before the Association and by vote referred to the Council with full power to act.

Edmund C. Sanford,
Secretary for 1895.
Clark University.

TENTH ANNUAL MEETING OF THE IOWA ACADEMY OF SCIENCES.

The Iowa Academy of Sciences met for its tenth Annual session in Des Moines, January 1st, 2d and 3d, 1896, in the Horticultural rooms at the Capitol Building. The attendance and interest at this meeting surpassed all previous gatherings of the Academy and were very encouraging.

Prof. H. W. Norris in his address as retiring President took for his subject 'Needed Changes in Scientific Methods.' The address was full of excellent suggestions, both for scientific workers and for the public, who look to scientific investigation for assistance in economic problems.

'The Homologies of the Cyclostome Ear,' read by Prof. Norris, presented evidence that the ear of Cyclostomes, though differing so markedly from that of ordinary vertebrates, is still capable of being homologized perfectly with the ear in other orders.

Prof. C. C. Nutting read a very interesting paper on 'Origin and Significance of Sex,' setting forth the theory of Geddes and Thompson as presented in their work on the evolution of sex and detailing some very interesting studies of his own on the development and determination of sex in Hydroids.

Prof. T. Proctor Hall presented papers on 'Unit Systems and Dimensions of Units,' 'Gravitation,' 'A Mad Stone.' In the last paper he described a peculiar absorptive power of the rock, being able to absorb one-half more water by volume than the rock itself.

Prof. L. W. Andrews presented the following papers: 'The Influence of Moisture on the Ignition Point of Sulphur,' and 'The Reduction of Sulphuric Acid as a Function of the Temperature.'

Prof. W. S. Franklin presented a paper on 'A New Electrical Generator for Oxygen and Hydrogen.' Prof. L. A. Youtz gave an account of the Indianola clay and pottery works.

Prof. L. H. Pammel gave an account of the flora of Western Iowa, calling attention to peculiar Western plants found on the bluffs along the Missouri river. In a second paper with Prof. F. Lamson-Scribner, he enumerated the grasses found between Jefferson, Iowa, and over the Rocky Mountains—the gradual change from blue grass

in Iowa to blue stem and game grasses of the plains.

Mr. F. C. Stewart and G. W. Carver presented a paper on 'Inoculation Experiments with Gymosporangium Macropus,' in which it was shown that different varieties behave quite differently with respect to the fungus.

Prof. L. S. Ross, in a paper on 'Preliminary Notes on the Iowa Entomostraca,' showed that this interesting and economic group of animals is much neglected. His collections were made at Lake Okoboji and Spirit Lake.

Prof. T. H. McBride, in a paper on 'Forest Distribution in Iowa and Its Significance,' laid special stress on the distribution of trees in Iowa on the loess. The various theories advanced to account for the absence of trees in Iowa have some foundation and only partially explain the absence of trees. There is much in the theory of Prof. McGee on the relation of the loess to the distribution. In a second paper on 'County Parks' he advocated the establishment of county parks for the purpose of retaining some of the many wild plants once common in Iowa, and for the purpose of giving the people needed recreation.

'Recent development in the Dubuque lead and zinc mines,' by A. G. Leonard. The production from this region in 1895 was 750,000 pounds of lead and 3,500 tons of zinc. The increase is due to better mining and the recovery of ore from the 'fourth opening.'

'Some facts brought to light by deep wells in Des Moines county,' Iowa, by F. M. Fultz, detailed the discovery of certain deeply buried river channels which leads to the inference of a later origin of the drainage than previously argued by the author.

'Recent discovery of glacial scorings in southeastern Iowa,' by F. M. Fultz. Marks of the presence of the Illinois ice, in a set of striæ bearing S. 79° W., have been noted by Mr. Leverett and the author.

'The Buchanan gravels, an inter-glacial deposit in Buchanan county,' by Samuel Calvin, describes a series of gravel beds lying between the Kansan and Iowan drift-sheets and located near Independence.

'The Le Claire limestone,' by Samuel Calvin. The local variations in thickness and dip are referred to the conditions of deposition and are regarded as due to cross-bedding.

'Variations in the position of the nodes of the axial segments of the pygidium of a species of Encrinurus,' by W. H. Norton. The small classificatory value of the characteristic is shown.

'A Theory of the Loess,' by B. Shimek. The æolian origin of the deposit is advocated from a study of the loess-fossils, the timber distribution and certain field relations.

Prof. J. L. Tilton presented two papers, one on the 'Slate area of near Nashua, N. H.,' and the other 'Notes on the Geology of the Boston Basin.'

'Observations on the Cicadidæ of Iowa,' by Herbert Osborn, included a list of the known Iowa species of this family and discussion of the distribution of *Cicada septendecem* in the State.

Other papers presented or in some cases read by title were: 'Perfect Flowers in Salix,' by Prof. B. Shimek; 'Some Anatomical studies of Sporobolus and Panicum,' by Miss Emma Pammel and Miss Emma Sirrine; Contributions to a Knowledge of the Thripidæ,' by Miss Alice M. Beach; 'A Review of the Genus Clastoptera,' by Mr. E. D. Ball; 'Notes on Chromogenic Bacteria,' by L. H. Pammel and Robert Combs; 'A Brief Study of a Curious Water Organism,' by F. M. Witter; 'A Comparative Study of the Spores of North American Ferns,' by C. B. Weaver; 'Two Remarkable Cephalopods' and 'Note on the Nature of Cone in Cone,' by C. R. Keyes. 'Biologic Notes on Certain Iowa Insects,' by H.

Osborn and C. W. Mally; 'Anatomy of Sphærium sulcatum,' by Gilman Drew; 'Fungus Diseases of Plants at Ames,' by L. H. Pammel and G. W. Carver; 'Notes on the Remains of Elephas and Mastodon,' by S. W. Beyer.

These papers will, with few exceptions, appear in the Academy proceedings which will be issued at as early a date as possible. The Academy is in a very flourishing condition, having now something over one hundred members. Its proceedings are published by the State and it is incorporated under State law. Its library and exchanges have grown rapidly in recent years, and there is every season to believe it will have a decided influence in advancing the cause of scientific research in the State.

The following officers were elected for the coming year: President, T. Proctor Hall; 1st Vice-President, W. S. Franklin; 2d Vice-President, T. H. Macbride; Secretary and Treasurer, Herbert Osborn; Additional members of the Executive Committee, W. S. Hendrixson, M. F. Arey, W. H. Norton.

Herbert Osborn,
Secretary.

CALIFORNIA SCIENCE ASSOCIATION.

The second annual meeting of the California Science Association was held in Oakland, January 3 and 4, 1896. President Jordan, of Stanford University, delivered the annual address as President of the Association on 'The Foundation of Belief.'

The following list of papers was read:

1. *A Memoir of Dana:* Joseph Le Conte.
2. *The Action of Anhydrous Ammonia and Anhydrous Aluminium Chloride:* J. M. Stillman.
3. *A Quantitative Separation of Iodine from Chlorine:* M. Adams.
4. *A Plea for an Aero-Physical Observatory on Mt. Tamalpais:* A. McAdie and W. H. Hammon.
5. *Notes on the Accuracy of refractive Index Determinations:* D. W. Murphy.
6. *The Manufacture of Artificial Food Products:* S. W. Young.
7. *The Maintenance of Constant Temperatures:* S. W. Young.
8. *A Modification of the Bunsen Ice Calorimeter:* F. Sanford.
9. *A Relief Map of California:* N. F. Drake.
10. *A Relief Map of Oregon:* S. Shedd.
11. *Some Lecture Experiments in Chemistry:* W. B. Rising.
12. *On Micro-chemical Analysis:* W. B. Rising.
13. *Use of Hydro-bromic Acid in the Estimation of Mercury and Cinnabar:* W. B. Rising and V. Lenher.
14. *Chemical Behavior of Liquid Hydroiodic Acid:* F. G. Cottrell and R. S. Norris.
15. *The Criterion of Continuity:* Irving Stringham.
16. *Logarithmic Orthomorphosis:* Irving Stringham.
17. *The Nine-Point Rectangular Hyperbola:* A. V. Saph.
18. *Simplification and Extension of Gauss's Third Proof of the Fundamental Theorem of Algebra:* M. W. Haskell.
19. *Note on Fermat's Theorem:* M. W. Haskell.
20. *Notes on the Imaginaries in Plane Coördinate Geometry:* R. L. Green.
21. *Note on Partial Differential Equations:* R. E. Allardice.
22. *Notes toward the Life History of the 'Water Dog' or California Newt (Diemyctylus torosus):* W. E. Ritter.
23. *A few Observations on the Hydroidea of San Francisco Bay, particularly concerning their Reproduction:* W. E. Ritter and H. B. Torrey.
24. *Respiration in Women:* Miss C. D. Mosher.
25. *Effect of Variation of Temperature on Muscle Irritability:* R. L. Wilbur.
26. *Refractory Period in an Isolated Strip of Cardiac Muscle of the Turtle:* Miss E. Briggs.
27. *Note on the Structure of the Brain of Embryo of Gerrhonatus:* A. B. Spaulding.
28. *The Development of the so-called Phosphorescent Organ of Poricthys notatus:* C. W. Greene.
29 *Note on the Function of the Air Bladder of Poricthys notatus:* C. W. Greene.
30. *Latitude and Vertebræ in Fishes:* D. S. Jordan.
31. *Distribution of Trout in California:* D. S. Jordan.
32. *Some points in Plant Geography:* E. W. Hilgard.
33. *A New California Liverwort:* D. H. Campbell.
34. *Some Facts concerning California Tunicata:* F. W. Bancroft and W. E. Ritter.
35. *The Mallophaga:* V. L. Kellogg.
36. *Explorations of the U. S. Fish Commission in 1895:* O. P. Jenkins.
37. *A new form of Microtome:* O. P. Jenkins.

The officers elected for the ensuing year are: Chas. H. Keyes, *President;* Irving

Stringham and Fernando Sanford, *Vice-Presidents;* M. W. Haskell, *Secretary;* R. L. Green, *Treasurer;* John D. Parker, *Custodian*. These, with the former Presidents, Joseph Le Conte and David Starr Jordan, constitute the Executive Committee.

The next meeting will be held at the State University in Berkeley.

M. W. HASKELL,
Secretary.

CURRENT NOTES ON PHYSIOGRAPHY.

ANNUAL RANGE OF TEMPERATURE OF THE OCEAN SURFACE.

THE annual range of temperature in the lower atmosphere, first clearly charted by Supan (Zeitschr. für wissensch. Geogr., 1880) and more recently by Conolly (see my Elementary Meteorology, fig. 18), is recognized as an important climatic factor, and the distribution of its larger and smaller values brings forward several interesting physiographical generalizations. Dr. G. Schott now presents a similar chart for the annual range of temperature of the ocean surface (Pet. Mitt., July, 1895,) from which it appears that the maximum range, 15° to 20° C., occurs on latitude 40° N., next east of the continents. Belts of large range, 5° to 7° in the southern hemisphere, 8° to 12° in the northern hemisphere, run around the oceanic world about 38° north and south, that is, under the belt of high atmosphere pressure and prevailingly clear skies; and small ranges are generally found around the equator, 1° to 3°, and in high latitudes, 2° in the far southern ocean, 4° to 6° in the far north. Dr. Schott ascribes the maximum ranges to the oscillation of cold and warm currents; and to this the contrast between the off-shore winds of summer and winter, by Nova Scotia and Corea, may fairly be added. Locally increased ranges on the equator, up to 5° or 6°, west of Africa and South America, are explained by the weaker and stronger flow of the South Atlantic and South Pacific eddies in the southern summer and winter.

WINDS OF THE PACIFIC OCEAN.

THE mean strength of the winds over the Pacific Ocean is discussed by Köppen in the *Annalen der Hydrographie* (July and August, 1895), in preparation for the publication of a *Segelhandbuch*. The velocities, without regard to directions, are presented in tabular form and in charts for the opposite seasons of January–February and July–August. Apart from the practical value of these results to navigation, they present interesting features characteristic of the planetary and terrestrial schemes of atmospheric circulation. Where the material is most plentiful, one may easily recognize the weak winds and calms of the planetary system around the equator, between the steady trades on either side; the frequency of calms again, but also of stronger winds in the horse latitudes, about 30° north and south; and the rapid increase of strong winds in the higher latitudes of the prevailing westerlies. Terrestrial features appear in the annual migration of these wind belts, not however symmetrically about the equator, but about a medial line in perhaps 5° north latitude; and also in the seasonal variation of the strength of the westerlies, from over 4 (Beaufort scale) in summer to over 5 in winter in the northern temperate zone, from over 5 to over 6 in the far southern zone. The irregularities of the planetary belts and of the terrestrial migrations may, in great part, be plausibly referred to cyclonic disturbances, but need much further investigation. The light equatorial winds shift south of the equator only near Australia, where monsoon winds and a seasonal counter current may be searched for.

ABNORMAL AND SOLITARY WAVES.

REPORTS are not infrequently made of waves or 'seas' of exceptional size, erro-

neously called 'tidal waves,' by which vessels are overwhelmed on the open ocean. C. E. Stromeyer gives brief account of some examples in *Nature* (li., 1895, 437), describing them as strong enough to carry masts and funnels by the board, and to smash bulwarks, lifeboats and deck houses. He suggests that the waves may be due to volcanic action in the submarine bank known as the Faraday reef, northeast of Newfoundland, for in a number of cases the course of the waves is away from the reef. The same subject is continued by W. Allingham in the (London) *Nautical Magazine* (lxiv., 1895, 539–545), many examples being given. The *Vancouver*, of the Dominion line, was badly mauled by a solitary sea while crossing the North Atlantic in 1890. The *Holyrood*, in June, 1892, 20°N, 35°W, encountered a solitary sea which looked like a wall of water as it approached; it flooded the decks, but before and after this sea broke, the water was comparatively smooth under a light northeast trade wind. The *St. Denis*, New York to Yokohama, in September, 1893, 28° S, 8° E, was boarded by a solitary sea which swept her decks and carried away three seamen. The *Normannia*, 750 miles out from New York, January, 1894, suddenly encountered a sea 'running masthead high,' submerging the vessel up to her bridge, and doing great damage.

Similar phenomena of smaller dimensions are reported on our great lakes. So little is known of them that no satisfactory explanation of their occurrence can be at present adopted.

W. M. Davis.
Harvard University.

TYPES OF LOWLAND COASTS.

As the opening paper to the Richthofen Jubilee volume (Festschrift Ferdinand Freiherrn von Richthofen, von seinen Schülern. Berlin, 1893), Dr. Alfred Philippson, of Bonn, contributed a discussion of type forms of coasts, particularly of alluvial coasts (Uber die Typen der Küstenformen, insbesondere der Schwemmlandküsten).

Under 'die cüste' he includes a zone on either side of the shoreline. He describes as 'Isohypsenküsten' those coastal forms which have been produced by the various constructional processes, such as deformation, depression of land, uplift of sea bottom, volcanic and glacial aggradation. These forms vary so greatly that one can make of them as many types as one pleases.

The present writer prefers to call this class of shore forms 'Constructional,' for in cases of tilted or warped crustal movement the new shoreline does not coincide with a former contour (Isophypse). Philippson recognizes that development must follow the constructional stage, and coastal irregularity from differential marine erosion is therefore explained, and the minute forms of beach profile are illustrated with five diagrams. He amplifies with illustrations his terms, potamogenous or river-made and thalassogenous or sea-made coasts, first introduced in connection with his work on Greece.* Though he introduces the idea of systematic change in the geographic form of coasts, as in 'incompletely potamogenous' and 'completely potamogenous' alluvial coasts, he does not fully carry out this idea and make a systematic account of all successive stages of development. It would make the comprehension of the various forms of coasts much easier to introduce the terms already applied to land forms and speak of a coast as young, adolescent or mature.

F. P. G.

CURRENT NOTES ON ANTHROPOLOGY.

SKIN PAINTING IN SOUTH AMERICA.

At the last session of the Italian Geographical Congress, an interesting paper was read by Guido Boggiani, on the supposed tattoo marks on Peruvian mummies.

* Peloponnes, Berlin, 1892, p. 509.

Various authors (Virchow, Danielli, Joest) have spoken of these colored decorative marks as true tattooing. Boggiani, however, by a closer examination of them, reaches the opinion that they are paintings. The materials used are various, as ferrous oxide, cinnabar and the juice of the *Bixa orellana*; but that which produces the peculiar tattoo-like appearance is the juice of the *Genipa oblongifolia*, a sort of indigo fluid, blue at first and turning black on exposure. It has a slight corrosive action on the skin, attacking the tissues of the epidermis, and thus gives to the marks which it leaves singular permanency, and the appearance of tattoo cicatrices.

The article of Boggiani is well illustrated, and is conclusive in establishing the prevalence throughout large areas in South America of the use of this plant.

ÆSOP IN AZTEC.

NATIVE Mexican, that is, Nahuatl or Aztec literature, is increasing to a respectable extent. Scarcely a year passes that some product of the printing press appears in this ancient and rich language. One of the latest is the Fables of Æsop, published by Dr. Antonio Peñafiel, from a sixteenth century translation. It is a pamphlet of 37 pages on good paper and in clear type.

No certainty has been reached as to the translator. It may have been Father Sahagun, but I am inclined to Father Bautista or some of his associates in the college at Tlatelolco, where the native youth were instructed in humanities and religion. It was probably intended as a reading book for them, and the forty-seven fables it contains, rendered into the Nahuatl of that early day, may still be followed as models of grammatical purity.

THE READING OF QUIPUS.

IT is well known that the ancient Peruvians had a method of preserving their records by means of strings, varied in hue, of different lengths and texture, and knotted in sundry designs. The early historians offer no clear explanation of them, and differ widely in estimates of their value as records of facts and ideas. They were called *quipus* —cords.

It appears that they are still in use, and Dr. Uhle, in the Ethnologisches Notizblatt, of the Museum of Ethnography, Berlin (Heft 2, 1895), explains several which he found among the shepherds about Lake Titicaca. They relate to the animals under their care. The color indicates the sex, or some other special series. The system is decimal, the position indicating the tens and hundreds. Those examined proved to be merely mnemonic aids, based chiefly on arithmetic ideas, and apart from these unintelligible by themselves. Doubtless the ancient *quipu* readers extended their use to all the needs of life in this direction, but their principles of interpretation must have been the same.

D. G. BRINTON.
UNIVERSITY OF PENNSYLVANIA.

SCIENTIFIC NOTES AND NEWS.

ASTRONOMICAL.

THERE are numerous cases in astronomical literature where astronomers have rejected certain observations because they did not agree with their own. But it is really not often that we find an astronomer gravely rejecting an observation simply because it *did* agree with his own. In one of his recent double star orbit discussions, Dr. See, of Chicago, omitted to use certain observations of Prof. Knorre. Dr. Brendel objected to this omission on the part of Dr. See, in a recent number of the *Astronomical Journal*. Now Dr. See replies, in the same journal, that he omitted Prof. Knorre's results because they were nearly identical with his own! But Dr. See's reputation as an astronomer is so good that we fear he will really have to find a better reason for rejecting observations than the mere fact of their agreement with his own. The whole thing looks like a comedy of errors to which the present note will perhaps add a final amusing scene. H. J.

THE London *Times* states that the President of the Royal Astronomical Society has announced the plans of the permanent eclipse committee in view of the eclipse of the sun occurring on the 9th of August, this year, and that two new instruments to be used in observations have been shown to members of the Society. One of these, the cœlostat, suggested by M. Lippmann, in the *Comptes Rendus*, has been made on the advice of Dr. Common, who has contributed the plane mirror of the instrument. Its purpose is to deflect the rays of the object into a fixed telescope, instead of having to put the telescope itself in motion. The second instrument is a modification of the Foucault heliostat, by Captain Hills; and this, in similar manner, deflects the image rays. It is said that Dr. Common will accompany the expedition to Vadsö, and will take photographs, with a long axis mirror or lens, of the lower portion of the corona. The telescopes and the spectroscopes will be the same as formerly employed, for the sake of continuity. Two steamships will be sent from London to Vadsö on the Varanger Fiord, which will afford tourists as well as men of science a convenient opportunity to witness the eclipse.

RUSSIAN SCIENCE NEWS.

THE Imperial Academy of Sciences of St. Petersburg has elected as honorary members, Hermite, Weierstrass and Pope Leo XIII; as corresponding members, Darboux, Klein, Fuchs, Jordan, Picard, Poincaré.

THE academicians Sonine and Markov have commenced an edition of the collected works of Pafnooti Lvovich Chebîshev, in Russian and French. All papers written in Russian will be translated into French, and *vice versa*. A translation of the greatest work of Lobachévski, his 'New Elements of Geometry with a Complete Theory of Parallels,' is so much desired by men of science that at the Centenary Anniversary of the Institute of France Sophus Lie and Darboux addressed to the representative of the Russian Academy of Sciences the request that all the works of Lobachévski be published in French. Without waiting for the effect of this request, negotiations have been set on foot looking to the publication in Paris by Gauthier-Villars or A. Hermann, of a French translation furnished from America but edited by Professor A. Vasiliev, the great Russian authority on Lobachévski.

VASILIEV's address on Lobachévski has been reproduced in German by Prof. Friedrich Engel, of the University of Leipzig, who acknowledges his indebtedness to Halsted's English translation, reviewed in this journal March 29, 1895.

K. A. ANDREYEV, President of the Mathematical Society of Charkov, has issued an important monograph on Vasíli Grigorevich Imshenetzki, with a handsome portrait. It includes biography, critical estimate and bibliography. GEORGE BRUCE HALSTED.

GENERAL.

THE names of the members of the general committee of the Huxley Memorial have now been published. The total number is about 800, of whom about 50 are Americans. We have not learned of any steps having been taken to organize an executive committee in America, and it is not clear whether intending subscribers should wait for this or should send their subscriptions to England. Donations may, however, be sent to the Treasurer, Sir J. Lubbock, or the bankers, Messrs. Robarts, Lubbock & Co. (15, Lombard Street, E. C.), or to the Honorary Secretary, Prof. G. B. Howes (Royal College of Science, South Kensington, S. W.).

THE French government has voted £400 towards the fund for erecting a statue in Paris to the memory of Pasteur; the fund exceeds the expense, and the surplus is to be used for a bust of Pasteur in the Pasteur Institute. As already stated in this journal, there have also been formed committees at Chartres and Dôle for the purpose of erecting statues to the memory of Pasteur in those towns. The French Chamber of Commerce in London would be glad to receive subscriptions for the monument to be erected in Dôle, the birthplace of Pasteur. Subscriptions may be sent to the President, M. Marius Duché, Monument House, E. C.

MR. ROBERT T. HILL, of the United States Geological Survey, sailed on the 18th of January upon the third of a series of geological recon-

naissances of the tropical American region, which he is undertaking under the auspices of Prof. Alexander Agassiz. He will visit many points of geologic interest concerning which knowledge is much needed. The plan of these researches is to acquire accurate detailed knowledge of typical regions in order that the whole of the complicated history may be ultimately interpreted. Mr. Hill's report upon the geology of the Isthmus of Panama and adjacent regions of Costa Rica, embodying the results of last winter's investigations, is nearly completed, and will deal minutely and thoroughly with the complicated and interesting geology of the region.

DR. DAVID STARR JORDAN was elected President of the California Academy of Sciences at its recent annual meeting.

THE next annual meeting of the British Medical Association will be held in Carlisle.

THE memorial to John Rae, the Arctic explorer, which has been executed in London by Mr. Whitehead, has been placed in St. Magnus Cathedral, Kirkwall. The monument stands opposite that of Baike, the African explorer.

AT the annual meeting of the American Society of Naval Engineers, Chief Engineer E. D. Robie was elected President, and passed Assistant Engineer F. C. Bieg, Secretary and Treasurer.

Natural Science states that the Geological Survey of India has begun a folio publication entitled *Quarterly Notes*, and the Geological Survey of Mexico has begun a *Boletin de la Comision Geologica de Mexico.*

AT the annual meeting of the American Geographical Society held at Chickering Hall, New York, on January 13th, Judge Charles P. Daly was elected President. The Society has received the legacy of $100,000 bequeathed by the late General George W. Cullom, to provide for the construction of a fire-proof building.

THE latest advices from Honolulu state that after a pause of thirteen months Kilauea is in active eruption.

ACCORDING to the New York *Evening Post* preparations are in progress at Glasgow University for celebrating Lord Kelvin's fifty years' connection with that body.

THE gold medal of the Royal Astronomical Society of London has been awarded to Dr. Seth C. Chandler for his work on the variation of terrestrial latitude and variable stars.

PROF. E. RAY LANKESTER has been appointed a Vice-President of the Royal Society.

WE learn from *Nature* that the inhabitants of Zürich have rejected, by 39,476 votes to 17,297, a proposal submitted to them for the absolute prohibition of vivisection. On the other hand, a counter proposal of the Grand Council in favor of the protection of animals with due satisfaction to the demands of science was adopted by 35,191 votes to 19,551.

A CABLEGRAM to the daily papers states that Eyvind Astrup, the Norwegian explorer who was with Lieutenant Peary in Greenland, is missing. He started to make an expedition in the mountains during the Christmas holidays, and has not since been heard from. A party has been formed to go in search of him.

MESSRS. MACMILLAN & CO. have in preparation a *Dictionary of Philosophy and Psychology*, edited by Prof. J. Mark Baldwin of Princeton.

THERE will be held at Innsbrück, from May to October of the present year, an International Exhibition of Hygiene.

THE late Baron Larrey has left a bequest to the Academy of Sciences for an annual prize of $5,000 for the best treatise by an army doctor on any question of medicine, surgery or sanitation.

IT is stated that $22,500 have been subscribed towards defraying the expenses of the meeting of the British Association in Toronto in 1897: $10,000 by the Dominion government; $7,500 by the Provincial government, and $5,000 by the corporation of the city.

THE Vienna *Presse*, the London *Standard* and other daily papers report what purports to be an extraordinary discovery by Prof. Röntgen. It is claimed that he has found that the ultra violet rays from a Crookes' vacuum tube penetrate wood and other organic substances, whereas metals, bones, etc., are opaque to them. It is said that he has thus photographed the bones in the living body, which would be one of the most important advances that has ever been made in surgery. The photographs

have been sent to Vienna and are in the hands of Prof. Bolzmann, who has, it is said, accepted the discovery, though he has not succeeded in his attempt to repeat the experiment. In spite of apparently absurd statements concerning the action of the ultra violet rays, it is not impossible that substances such as metals, which are good conductors of heat, should absorb the ultra violet rays, while substances such as wood, which are bad conductors of heat, should transmit them. Prof. Röntgen is professor of physics at Würzburg, and any experiments published by him would be accepted without hesitation.

We learn from the *International Medical Magazine* that the Royal Academy of Medicine of Belgium offers prizes of 5000, 8,000 and 25,000 francs for the best researches on the diseases of the central nervous system with special reference to epilepsy. The competition closes on the 15th of September, 1899. Smaller prizes are offered in 1896 on subjects pertaining to pharmacology and the blood.

Prof. Camille Flammarion reported to the Paris Academy on December 30th further experiments on the effects of colored glass on the growth of plants; he found the order in the development of height in sensitive plants for different glasses to be: red, green, transparent, blue. The plants grown under the transparent glass, however, surpassed in vigor those grown under the green glass. He secured similar results, but less marked, with geraniums, strawberry plants, pansies, etc. In the discussion that followed, M. Armand Gautier stated that he had found that vegetables grew well under red light, less well under yellow light, still worse under violet light and that they died under green light. He had placed pots of flowers in a current equal to that from three Bunsen cells for two and a-half months, and had found that the plants growing in the soil through which the currents passed had grown twice as as much as those placed under the same condition, but without the current.

It is stated that it is proposed to build a railway or elevator to the summit of Mount Blanc in a manner similar to that planned for the Jungfrau. A tunnel would be built beginning at a height of 2,200 meters above the sea level and the length of the shaft would be 2,539 meters. A hotel would be built at the summit and the entire ascent would occupy only thirty minutes.

The capital necessary for the purpose of sending an expedition to the Antarctic regions with a view to carrying on whale and sea fishing has been subscribed in London. It is proposed to send out two whaling steam vessels of 300 or 400 tons, and, we understand, also one or more of the smaller steamboats which are used by the Norwegians for the capture of the blue whale. If £5,000 can be collected to defray the expenses Mr. Borchgrevink with eight or ten companions will accompany the expedition with a view to scientific research.

It appears that in the French expedition to Madagascar the mortality from fever amounted to 5,000 or one-fourth of all who took part in the expedition; fifty per cent. of the whole number were seriously ill, and of twenty-five per cent. remaining, scarcely any entirely escaped. Only seven men were killed in battle. In the Japanese-Chinese War 3,148 of the 200,000 Japanese soldiers engaged in the contest died as the result of disease, and 969 as the result of injury in battle.

A correspondent of the *London Times* states that the war against rabbits in Australia seems to have had but little result. Since 1883 New South Wales, alone, has spent over $5,000,000 in the attempt to subdue or exterminate them, but apparently without effect. A reward of $125,000 has been offered by the New South Wales government for an efficient method of getting rid of the pest. The final outcome of Royal Commissions, of intercolonial conferences, and of the testing of every practical method of extermination, is that the most effectual method of dealing with the evil is found to be the construction of rabbit-proof netting, by means of which the animals can be kept from areas not yet infested; can be shut off from food supplies; and can be more effectually dealt with locally. In New South Wales alone 15,000 miles of rabbit-proof netting has been erected, but in this colony 7,000,000 acres have been abandoned largely owing to the gravity of the pest.

Natural Science has adopted with its January number the plan recently reported in this journal of underlining the most important word or words in the title of each article, and of giving at the head of the article the index number under which the article is placed in the Dewey system of classification. The index number, supposing a satisfactory system of classification can be agreed upon, would seem to satisfy the requirements of bibliographical classification. The significant word in the title is usually easy to discover, and when the title is well chosen all the words are apt to be significant. Thus the articles in the current number of *Natural Science* on 'The Endeavor After Well Being;' 'The Constantinople Earthquake of July 10, 1894,' and 'The Perth Museum of Natural History,' have all the words excepting the articles and prepositions partly or entirely underlined. It might, however, lead authors to be more careful in the choice of titles if they considered the necessity of underlining the words significant of the contents of the article.

UNIVERSITY AND EDUCATIONAL NEWS.

CONTRACTS have been awarded for the construction of the Schemmerhorn Hall of Natural Sciences and the Hall of Physics for Columbia College. The buildings will be ready for occupancy in the summer of 1897. The Trustees of Barnard College, at a meeting held on the 17th ult., accepted the plans and specifications for the proposed new building to be erected at the Boulevard and 119th street. The building is to be 200 by 160 feet, and will cost about $500,000.

THE Council of the University of the City of New York has decided to continue the summer courses inaugurated last year. The session will be held at University Heights from July 13th to August 21st. Courses will be offered in ten departments.

PROF. J. H. VAN'T HOFF, the brilliant chemist, now at Amsterdam, has resigned, probably to take a place created for him in the University of Berlin. The city of Amsterdam and the Dutch government made every effort to prevent him from leaving Holland. The authorities of the University offered to appoint an assistant professor whose duty it should be to give all the lectures and attend to all examinations. All that they required of Van't Hoff was the givin of two lectures a week. It is doubtful whether any professor has ever received a more flattering offer.

THE Boston *Transcript* states that some years ago J. H. Armstrong, of Plattsburg, deeded a considerable property to Union College, but retained a life interest in it. On January 2d of this year he died, and by his will added to the gift, which now amounts to $100,000. Mr. Armstrong was a lawyer, and it was his intention that the department of sociology should be benefited by his will.

THE Legislature of Massachusetts has passed the bill appropriating $25,000 to the Massachusetts Institute of Technology.

MRS. JOSIAH N. FISKE has given Barnard College $5,000 for the foundation of a scholarship which will be open to competition.

DISCUSSION AND CORRESPONDENCE.

MARSH GAS UNDER ICE.

AN interesting chemical experiment, quite new to me, was performed by a party of skaters in the neighborhood of Baltimore a few days ago. It is possible that it has been performed before, but I have not yet found any one who has seen or heard of it, and I therefore think it may interest the readers of SCIENCE. The skaters were on a large artificial lake upon which remarkably clear ice had formed. In various places white spots were noticed in the ice, suggesting, as one of the skaters said to me, 'air bubbles.' Some one bored a hole through one of these white places, and applied a flame to the gas, which took fire. This led to further experiments, and it was found that, by boring a small hole, a long thin jet of flame could be obtained, and this continued for some time. The gas was, of course, marsh gas, formed by the decomposition of the vegetable matter at the bottom of the lake. The above method of demonstrating the formation of this gas in nature is, from the æsthetic point of view, a great improvement on the usual method described in the text-books, which consists in stirring a pool of stagnant water with a stick, and collecting the gas that rises to the surface.

Skating ponds illuminated by natural gas are among the possibilities of the future.

IRA REMSEN.

BALTIMORE, January 14, 1896.

'PROFESSORS' GARNER AND GATES.

THE daily papers state that Mr. Richard L. Garner, whose alleged investigation of the speech of monkeys has been so prominently advertised, is again expected in America. Accounts of the alleged investigations of Mr. Elmer Gates on the development of the brain are also being extensively reported. It is perhaps the duty of a scientific journal to state that neither of these gentlemen has as yet published scientific work deserving serious consideration.

J. McK. C.

SCIENTIFIC LITERATURE.

The Psychology of Number and Its Applications to Methods of Teaching Arithmetic: By JAMES A. MCLELLAN, A.M., LL.D., and JOHN DEWEY, Ph.D. International Educational Series. D. Appleton & Co., New York.

This book makes a false analysis of the number concept, but advocates methods in teaching arithmetic which are in the main good. The conviction of its authors that the difficulties which children have with arithmetic are due to the neglect of teachers to lay sufficient stress on the metrical function of number has carried them to the extreme of maintaining that number is essentially metrical in its nature and origin. The conviction is well founded, inasmuch as the first serious difficulties of children are with fractions whose primitive function was unquestionably metrical and to which men in general attach no other than a metrical meaning; but there is no reason for drawing the conclusion that because the fraction, which is but a secondary concept of arithmetic, is metrical, its primary concept, the integer, is metrical also, or even that because a child can hardly be made to understand fractions without associating them with measurement, he requires the same help with integers. Nevertheless, the authors of this book maintain, in the most unqualified manner, that the integer is essentially metrical and should be taught accordingly. Thus they account as follows for the origin of number: Man found himself in a world in which the supply of almost everything that he needed was limited. To obtain what he required, therefore, an economy of effort, a careful adjustment of means to an end, was necessary. But the process of adjusting means to an end is valuable in the degree in which it establishes an exact balance between them. "In the effort to attain such a balance, the vague quantitative ideas of smaller and greater * * * were transformed into the definite quantitative ideas of just so distant, so long * * *. This demands the introduction of the idea of number. Number is the definite measurement, the definite valuation of a quantity falling within a given limit."

They define counting, the fundamental numerical operation as but measuring with an undefined unit. "We are accustomed to distinguish counting from measuring. Nevertheless, all counting is measuring and all measuring counting. The difference is that in what is ordinarily termed counting, as distinct from measuring, we work with an undefined unit; it is vague measurement because our unit is unmeasured. * * * If I count off four books, 'book,' the unit which serves as unit of measurement, is only a *qualitative*, not a *quantitative* unit."

And they formally define number as 'the repetition of a certain magnitude used as the unit of measurement to equal or express the comparative value of a magnitude of the same kind,' a definition which, so far as it goes, agrees, it is true, with that given by Newton in his *Arithmetica Universalis*, viz, 'the abstract ratio of any quantity to another quantity of the same kind taken as unit,' though Newton's purpose having been to formulate a working definition comprehensive enough to include the irrational number, it is anything but evident that this statement represents his analysis of the notion of number in the primary sense.

The immediate objection to all this is that it is much too artificial to be sound. And in fact it requires but a little reflection to be convinced that pure number is not metrical and that counting is not measuring, but something so much simpler that men must have counted long before they knew how to measure in any proper sense.

It is not enough to say that counting is the simplest mathematical operation; it is one of the simplest of intellectual acts. For to count a

group of things on the fingers is merely by assigning one of the fingers to each one of the things to form a group of fingers which stand in a relation of 'one-to-one correspondence' to the group of things. And counting with numeral words is not a whit more complex. The difference is only that words instead of fingers are attached to the things counted. But, the order of the words being invariable, the last one used in any act of counting is made to represent the result, for which it serves as well as the group of all that have been used would do. The group of fingers or this final numeral word answers as a register of the things by referring to which one may keep account of them as a child does of his marbles or pennies without remembering them individually, and this is the simplest and most immediate practical purpose that counting serves.

The number of things in any group of distinct things is simply that property of the group which the group of fingers—or, it may be, of marks or pebbles or numeral words—used in counting it represents, the one property which depends neither on the character of the things, their order nor their grouping, but solely on their distinctness. Gauss said with reason that arithmetic is the pure science *par excellence*. Even geometry and mechanics are mixed sciences in so far as their reality is conditioned by the correctness of the postulates they make regarding the external world. But the one postulate of arithmetic is that distinct things exist. It is an immediate consequence of this postulate that the result of counting a group of such things is the same whatever the arrangement or the character of the things, and this is the essence of the number-concept.

Counting, therefore, is not measuring and number is not ratio. Pure number does not belong among the metrical, but among the non-metrical mathematical concepts. The number of things in a group is not its measure, but, as Kronecker once said very happily, its 'invariant,' being for the group in relation to all transformations and substitutions what the discriminant of a quantic, say, is for the quantic in relation to linear transformations, unchangeable. Nor are the notions of numerical equality and greater and lesser inequality metrical. When we say of two groups of things that they are equal numerically, we simply mean that for each thing in the second there is one in the first and for each thing in the first there is one in the second, in other words that the groups may be brought into a relation of one-to-one correspondence, so that either one of them might be taken instead of a group of fingers to represent the other numerically. And when we say that a first group is greater numerically than a second, or that the second is less than the first, we mean that for each thing in the second there is one in the first, but not reciprocally one thing in the second for each in the first. Instead of comparing the groups directly we may count them separately on the fingers, and by a comparison of the results obtain the finger representation of the numerical excess of the one group over the other in case they are unequal. And this is all that is meant when we say that by counting we determine which of two groups is the larger and by how much.

It is therefore obvious, as for that matter our authors themselves urge, that the rational method of teaching a child the smaller numbers is by presenting to him their most complete symbols, corresponding groups of some one kind of thing as blocks, marbles or dots. By such aids he may be taught, with as great soundness as concreteness, not only the numbers themselves and their simple relations, but the meaning of addition, subtraction, multiplication and division of integers and the 'laws' which characterize these operations. This accomplished, he is ready to be taught notation and the addition and multiplication tables and to be practised on them until he has attained the art of quick and accurate reckoning. 'Measuring with undefined units' is a fiction with which there is no need to trouble him. For in however loose a sense the word may be used, 'measuring' at least involves the conscious use of a unit of reference. But no one ever did or ever will count a group of horses, for instance, by first conceiving of an artificial unit horse and then matching it with each actual horse in turn—which 'measuring' the group of horses must mean if it means anything. A conception of 'three' which makes 'three horses' mean in the last analysis 'three times a fictitious unit

horse' does not differ so essentially as our authors think from the 'fixed unit' conception of this number against which they protest so strenuously. And this fictitious operation is no more the essence of multiplication and division than it is of counting. Multiplication of integers is abbreviated addition. The product 'three times two' is the sum of three two's not, happily, the measure in terms of a primary undefined unit of something whose measure in terms of a secondary undefined unit is three, when the measure of the secondary unit itself in terms of this primary unit is two.

On the other hand, measuring in the ordinary sense—the process which leads to the representation of *continuous* magnitudes as lines or surfaces, in terms of some unit of measure—deserves all the prominence which our authors would give it in arithmetic. We do not mean measuring in the exact mathematical sense, of course, but the rough measuring of common life, in which the magnitude measured and the unit are always assumed to be commensurable.

Compared with counting, or even addition and multiplication, an operation which involves the use of an arbitrary unit, and the comparison of magnitudes by its aid, is artificial. But this metrical use of number is of immense practical importance and of great interest to any child mature enough to understand it. No doubt a child may use a twelve-inch rule to advantage when practicing multiplication and division of integers. Certainly such an aid is almost indispensable in learning fractions. Without it the fraction is more than likely to be a mere symbol to him, without exact meaning of any kind. 'Two-thirds' has a reality for the child who can interpret it as the measure of a line two inches long in terms of a unit three inches long, which it quite lacks for him who can only repeat that it is 'two times the third part of unity.' Mathematicians now define the fraction as the symbolic result of a division which cannot be actually effected, but that definition will not serve the purposes of elementary instruction. It is as certain that the fraction had a metrical origin as it is that the integer had not, and in learning fractions, as in learning integers, the child cannot do better than follow the experience of the race.

Our authors must, therefore, be credited with doing the cause of rational instruction in arithmetic a real service by laying the stress they do on this proper metrical use of number. Their chapters on the practical teaching of arithmetic, moreover, though unduly prolix, contain many excellent suggestions. It is a pity that a book in the main so sound in respect to practice should be wrong on fundamental points of theory. One can but regret that its authors did not take pains before writing it to read what mathematicians of the present century have had to say on the questions with which they meant to deal. Their conception of number might have been modified by the considerations which have led mathematicians to 'arithmetise' the higher analysis itself by replacing the original metrical definition of the irrational number by a purely arithmetical one. At all events their notions of certain mathematical concepts would not have been so crude; they would not have made such a use of mathematical terms as this: "Quantity, the unity measured, whether a 'collection of objects' or a physical whole, is *continuous*, an undefined how *much;* number as measuring value is discrete, how *many*."

H. B. Fine.

Princeton, December 31, 1895.

Experimental Farms. Reports for 1894. Printed by order of Parliament. Ottawa, 1895. 422 pp. 8°.

The direct application of scientific methods of investigation to practical questions has, perhaps, in no field found greater extension during the last decade on this continent than in agriculture.

The establishment of the experiment stations in connection with agricultural colleges in all our States by the Hatch Act of 1887 has revolutionized the possibilities of agricultural pursuits, and what this act did for the United States, Canada did the same year in perhaps a more efficient if not as extensive manner for its people. This greater efficiency we would attribute to the fact that the direction of the five experimental farms located in different parts of the country is concentrated in one director and one staff, thereby producing that unity of purpose which insures success.

There is considerable scientific interest in the present (8th) annual report, issued under the editorship of the able director, Prof. Wm. Saunders, who is acknowledged as ideally fitted for his position.

We can only refer to a few of the most interesting results reported:

Prof. Jas. W. Robertson, the agriculturist, gives an outline of comparative tests of pure cultures of bacteria in the ripening of cream, from which he deduces results of a most interesting nature, showing the practical application of science in butter making. It was found that the flavor of butter is largely determined by the bacteria which develop in milk and cream, and that the conditions favoring the most satisfactory development of such bacteria prevail in a perfectly clean, well ventilated dairy; the bacteria present in the atmosphere under such conditions being superior to any artificial cultures tested.

The Chemist, Prof. Frank T. Shutt, contributes a notable article on the chemistry of the apple, completing the record of an investigation begun in previous years. It appears from the tables accompanying this discussion that 1,000 pounds of the leaves of the apple contain, as an average of the results of analyses of four varieties, 7.42 pounds nitrogen, 2.45 pounds phosphoric acid and 2.52 pounds of potash, most of which is of course returned to the soil. Estimating the average crop of the four varieties analyzed at 160 barrels per acre, there is removed from each acre in every crop of fruit the following quantities of important fertilizing constituents: 8.952 pounds nitrogen, 5.228 pounds phosphoric acid, 32.808 pounds potash. The chemist then advises the turning under of a leguminous crop, wood ashes and barnyard manure as a means of restoring to the soil the elements removed in the fruit crop.

There is no unnecessary use of technical terms in this admirable paper, and the deductions are drawn so directly from laboratory results that the veriest tyro cannot fail to be impressed with the close relation of this science to agriculture. The chemistry of the strawberry plant and of copper-salt fungicides is also discussed.

The reports of the horticulturist, the entomologist and the poultry manager are of the same high order of practically applied science.

B. E. FERNOW.

Les Nouvelles Théories Chimiques. Par A. ÉTARD, Paris, G. Masson, et Gauthiers-Villars et fils. 12 mo., pp. 196.

This volume is one of a series, Encyclopédie Scientifique des Aide-Memoire, published under direction of M. Léauté, Membre de l' Institut.

The author aims to present, in brief outline, the principal chemical theories of the day. His book is divided into two parts. Part I. consists of three sections, containing in all six chapters. These are devoted to: Definitions and general principles; a discussion of the atomic and kinetic hypotheses; a consideration of the chemical properties of molecules dependent upon the three states of aggregation of matter—the solid, the liquid, the gaseous.

Part II. contains four chapters. The first of these refers to the relation between mechanics and chemistry; the others treat respectively of thermo-, photo- and electro-chemistry.

Concerning the nature of matter the author refers to the views held by some 'Dynamistes purs,' that matter has no actual existence, but that that which we term matter is rather a sort of illusion of our senses impressed by a group of factors depending on energy, space and time.

Matter, he says, can not be precisely defined; it is everything which has weight, which can be seen or felt. Chemistry is described as the science of the transformations experienced by matter.

It will be of interest to many to learn (p. 46) that A. E. Béguyer de Chancourtois in his Vis tellurique, classement des corps simples ou radicaux obtenu au moyen d'un système de classification hélicoïdal et numerique, Paris, 1863, is credited with being the first to have published a continuous classification of the elements arranged according to their atomic weights. It will be recalled that Newlands' first communication 'On Relations Among the Equivalents,' appeared in the Chemical News, February 7th, of the year mentioned.

Attention is also called to the various shortcomings of the Periodic Law, and the surmise is hazarded that perhaps some day this system

of classifying the elements may be abandoned and recourse again had to Dumas' system of grouping the elements in natural families—of course, with modifications suggested by recent advances in chemistry.

In discussing the ion theory of Arrhenius, the author declares the idea of ion movements in fluids to be but a form of the kinetic hypothesis, advanced by Bernouilli about the middle of the last century; the ion playing the part of the gaseous molecule.

The attempt to cover so wide a range in so narrow a compass as Étard has chosen has, of course, necessitated an exceedingly terse mode of treatment. Although exception may be taken to some minor points, the author is evidently thoroughly abreast of the times, and has certainly succeeded in presenting the essential features of the numerous and varied themes he considers clearly and concisely.

Ferdinand G. Weichmann.

SCIENTIFIC JOURNALS.

AMERICAN CHEMICAL JOURNAL, JANUARY.

On the constitution of Phenoquinone: By C. Loring Jackson and Geo. Oenslager. As a result of their work on the hemiacetals, compounds of the phenoquinone group, the authors suggest structural formulæ for phenoquinone and quinhydrone. They have determined the structure of the hemiacetals and base the present hypothesis on the great similarity between these substances and phenoquinone, the former being formed (theoretically) by the addition of two molecules of alcohol to quinone, and the latter by the addition of two molecules of phenol to quinone. They find the properties and reactions of the phenoquinone can be readily explained by this structure, and that in most cases the properties are those of the hemiacetals.

The Chemical Kinetics of Oxidation: By H. Schlundt and R. B. Warder. Warder reviews the work of a number of investigators on oxidation processes and discusses the results obtained by Schlundt, treating his curves mathematically, and drawing some general conclusions as to the theory of oxidation processes.

Composition of Ohio and Canadian Petroleums: By C. F. Mabery. The author continues the report begun in the last number of this journal. He finds that both Ohio and Canadian petroleum contain small quantities of benzol, toluol and xylols. Both these oils resemble the Russian oil more closely than they do the Pennsylvania, and the Canadian oil has a smaller quantity of substances belonging to the methane series than the Ohio oil. The author refers to the various views as to the origin of petroleum and the difficulty of obtaining evidence on this point.

This number also contains reviews of the following books: Chemical Analysis of Oils, Fats and Waxes, R. Benedikt and S. Lewkowitsch; Analytical Chemistry, N. Menschutkin; Solution and Electrolysis, W. C. D. Whetham; Grundriss der Elektrochemie, H. Jahn; Grundzüge der wissenschaftlichen Elektrochemie auf experimenteller Basis, R. Lüpke; Practical Proofs of Chemical Laws, V. Cornish.

J. Elliott Gilpin.

THE MONIST, JANUARY.

Prof. Mach, in the opening article (his inaugural lecture delivered on assuming the professorship of the History and Theory of Inductive Science in Vienna) discusses the part which chance, or rather *accident*, has played in invention and discovery. He considers the general relations of science to philosophy, gives practical examples of the devious ways by which knowledge has been accumulated, and formulates the conscious and unconscious methods employed by scientific discoverers in their search for truth.

In *Pathological Pleasures and Pains* Prof. Th. Ribot applies the pathological method of amplification, as furnished by disease, to the study of abnormal pleasures, with interesting results.

Dr. Carus gives an exhaustive study of *Chinese Philosophy*, accompanied by numerous tables, diagrams and ideographic characters. He has interspersed his discussions with sufficient history to make the science and philosophy of the Chinese intelligible, and to exhibit the causes on which their intellectual stagnancy rests. He has considered thoroughly the Chinese theory of permutations (a theory of philosophy which is mathematical in its character), their supposed employment of the binary system of numera-

tion, their cosmology, ontology, their ethics and religion.

In a long article Prof. August Weismann expounds and defends his new theory of *Germinal Selection*, a modification of Wilhelm Roux's idea of the principle of selection as applied to the *parts* of organisms—the struggle of the parts. Weismann reviews the *whole* status of the problem of the efficacy of natural selection, attacks the doctrines of internal formative laws and of internal motive forces in evolution, ascribing all impulse and guidance in the choice of variations to utility. Establishing the efficacy of selection by what he deems indisputable evidence, he contends, nevertheless, that natural selection does not explain a very important *crux* of evolution, viz, why the useful variations are always present. Something is wanting to the selection of *persons*, and that missing agency is supplied by *germinal* selection, which the author claims is the last consequence of the application of the principle of Malthus to living nature, and has its roots 'in the necessity of putting something else in the place of the Lamarckian principle,' which is declared to be inadequate. His treatment of the views of American inquirers on this point shows a higher appreciation of the strength of their position than we are accustomed to expect from European critics. In opposition thereto, however, he maintains—and here the whole burden of his objection rests—that since degeneration takes place in superfluous parts having only *passive* and not active functions, as in the chitinous parts of the skeleton of Arthropoda, therefore, it is certain that the cessation of functional action is not the efficient cause of degeneration. It is a curious and instructive circumstance that he grounds his arguments upon the same facts as his opponents, viz., on the facts of artificial selection. He repudiates the charge that his germ elements are modernized reproductions of Bonnet's preformations, and also argues for the simplicity of his theory of the constitution of the germinal substance as compared with that of Spencer. The mechanism of the selection and survival of the plus and minus determinants in Weismann's theory of the *germinal* battle for life is that of oscillations of the nutrient supply and of the *active* as well as passive assimilative powers of the struggling particles.

In the last article, *On the Nature of Mathematical Knowledge*, Prof. H. Schubert, of Hamburg, shows the varying degrees of certainty attainable in the different branches of mathematics as compared with each other and with the remaining sciences, and points out the leading features by which mathematical thought is distinguished from other rational processes.

Prof. Henry F. Osborn reviews the late Mr. Romanes's *Post-Darwinian Questions*. Other important works in science and philosophy also receive critical discussion.

SOCIETIES AND ACADEMIES.

BIOLOGICAL SOCIETY OF WASHINGTON. 253D MEETING, SATURDAY, JANUARY 11.

GERRIT S. MILLER read by title a paper on *the Sub-genera of voles* (*Microtinæ*).

T. S. Palmer spoke on *Rabbit Drives in the West*, illustrating his remarks with lantern slides. He alluded to the great destruction caused by the introduction of rabbits into New Zealand and Australia, and the efforts to check their increase, and described the damage to fruit and other crops in California. The drives were undertaken with the object of reducing the numbers of the rabbits and the principal locality where they were held was in the San Joaquin valley. The method was practiced on a limited scale by the Indians as far back as 1839, but the first of the modern drives by whites took place at Pixley, Cal., in November, 1887. The principle of a drive was as follows: A corral or pen of some kind was built with wing fences leading from it for a long distance, like a funnel, and a multitude of people, who assemble in response to notices and advertisements form a line and drive the rabbits toward this trap. The line may be several miles in length and it is formed some distance from the pen. The rabbits which try to double on the line are killed with clubs, and when the others have been driven into the trap, gates are shut and all clubbed to death. The number destroyed in 208 drives, including under this head the 'shotgun hunts' of Colorado and Utah, was 459,000, the average per drive being about 2,200; the greatest number killed at any one time was in March, 1892, at Fresno, Cal.,

when 8,000 people participated and 20,000 rabbits were taken.

Rabbit driving has declined in the San Joaquin Valley during the last three years, but is now being actively prosecuted in northeastern California and in certain parts of Oregon and Idaho, while thousands of rabbits are killed annually in the Colorado and Utah hunts. Drives can only be used in the case of Jack rabbits, which do not burrow, but under favorable circumstances afford a most efficient means of keeping the animals in check.

Dr. V. A. Moore read a paper on *The Nature of the Flagella of Motile Bacteria with special reference to their value in differentiating species.*

The paper was a summary of the present knowledge of the nature and significance of the flagella, or organs of locomotion, of motile bacteria. A method seems not to have yet been formulated whereby uniform results can be obtained by different investigators. This fact renders the assertions of a few writers that the flagella are of specific diagnostic value somewhat questionable. The test of the differential importance of these filaments was applied to *Baccillus coli communis, B. typhosis and B. choleræ suis*, three species of bacteria closely related morphologically, but readily differentiated by means of physiological properties and their pathogenesis. The differences in the flagella of each of these species as found by different observers are as great as those found between the different species. The same is true of the Spirilla. The proposed classification of bacteria by Messea was shown by illustration to be of secondary importance, and the statements heretofore made concerning the specific value of the flagella were shown to be unreliable. The author favored the disposition of the flagella, as polar or diffuse, made by A. Fisher, who includes them in the characters of his subfamilies.

F. A. Lucas,
Secretary.

NATIONAL GEOGRAPHIC SOCIETY.

At the regular Friday evening meeting of the National Geographic Society held in Washington, D. C., January 10, Mr. Wm. Ellery Curtiss, of Washington, delivered a lecture, illustrated by lantern slides, on Venezuela; her government, people and boundary. The lecturer, who was formerly Chief of the Bureau of American Republics, discussed the form of government and institutions of the country and the character, manners and customs of the people. He dwelt particularly, however, on the boundary question, in certain of its phases, and set forth both the British and American contentions in the pending dispute.

GEOLOGICAL SOCIETY OF WASHINGTON.

At the fortieth meeting of the Society, on January 9th, the first paper read was by Mr. R. T. Hill, of the U. S. Geological Survey, *On the Agassiz Expedition to Panama and Costa Rica.*

Mr. Hill gave results and methods of studies of the geological structure, paleontology and geomorphology of the Isthmus of Panama, based upon observations made by him last year, when, under a furlough from the Survey, he spent several months in the work, under the auspices of Prof. Alexander Agassiz. Mr. Hill supplemented his remarks by calling attention to the great work Prof. Agassiz is doing for science in working out the geology of Tropical America, a region having the greatest bearing upon the interpretation of our whole continental history.

The speaker made acknowledgment to the following specialists who had determined for him the many different types of material entering into this complicated section: To Dr. Wm. H. Dall, of the Geological Survey, for a report upon the Tertiary mollusca; to Prof. R. M. Bagg, of Johns Hopkins University, for interesting determinations of the Tertiary Foraminifera; to Prof. J. E. Wolff, of Cambridge, to whom the petrographic specimens were assigned; to Mr. H. W. Turner, of the Geological Survey, for minute examination of certain important and apparently indeterminate earths; to Mr. Ahc̊ Sjogren, of Stockholm, Sweden, late of Costa Rica, for carefully prepared sections and collections; and to Mr. T. Wayland Vaughan, of the U. S. Geological Survey, for determination of the fossil corals. The reports of these specialists, together with Mr. Hill's discussion of the structure, history, and physical geography, have been prepared and are nearly ready for publication.

Three geologic sections of the Central Ameri-

can region were presented by the speaker. The first of these was across the continent along the line of the Panama Canal and Railway. This consists of a complicated plexus of marine sedimentaries (Eocene and Miocene Tertiaries) igneous rocks (basalts, augite porphyrites, augite andesite, trachitic tufa, rhyolitic tufa and other species) and ancient detritial formations, so concealed by dense vegetation and soil (the subaereal decay, which reaches to 100 feet or more in depth,) and confused by structural disturbance that its history is most difficult to interpret. Another section was given across the Republic of Costa Rica from Punta Arenas to Port Limon, showing the contrasts between the high plateau, of recent volcanic activity and the older phenomena of Panama. The third section was from the Caribbean coast to the high mountain summits in southern Costa Rica. It is impossible to give here the great amount of detail which these sections throw upon the petrography, paleontology, orogeny and geomorphology of this exceedingly interesting region, and present for the first time any comprehensive detail by which its history may be discussed.

The discussion of the time of the union of the continents was intentionally deferred to the final report, owing to the fact that it is so involved in hypothetical discussion by naturalists that the subject requires separate treatment. "The Isthmus," said the speaker, "entirely aside from this question of the union of the oceans, is of the greatest geologic interest."

For the information of the Department of the Interior, and under special instructions from the Secretary, Mr. George H. Eldridge has just made an investigation of the principal mineral resources of the Uncompahgre Indian Reservation in northeastern Utah, and has submitted his report through the director of the Geological Survey. Mr. Eldridge contributed an interesting account of Uintaite, or Gilsonite, the principal resource found and investigated. His paper will be printed in this journal.

Prof. Chas. D. Walcott entertained the Society briefly with the presentation and informal discussion of two series of lantern-slide views. The larger series represented some recent and ancient markings on the sea shore, and showed the results of experiments and observations made by him quite recently on the beach at Noyes Point, Rhode Island, and on the Florida coast. The observations, while of interest in other respects, were presented more particularly as illustrating some supposed errors in the interpretation that observers have placed upon certain sea-shore markings. He illustrated among other things an excellent cast of a medusa, or jelly fish, one of several of which casts he had succeeded in making in plaster of paris while on the Florida coast. The other slides represented the mode of formation of sand dunes, as observed on the Rhode Island coast.

W. F. MORSELL.

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

THE 242 meeting of the Society was held on January 7. A paper on 'A Vigil of the Gods,' was read by Dr. Washington Matthews, U. S. A., of which the following is an abstract:

The rites occur on the fourth night of a great nine-days' ceremony of the Navahoes called the night-chant, which is based on a myth, and many of the acts are illustrative of the mythic events.

The night from about 9 P. M. until daylight is devoted to a vigil analogous to that of the mediæval knight over his armor. Men and gods, or the properties which represent the gods, alike participate in the vigil and there is a feast in common, or love-feast, closely resembling certain ceremonial acts observed among our own people to-day.

Although there are interesting rites, the night is spent mostly in song, and many long prayers are repeated. The songs and prayers are carefully formulated ritualistic compositions.

The masks of twenty-one gods and goddesses of the Navaho pantheon, along with other sacred properties, are spread on a buffalo robe in an established order and frequent sacrifices of pollen are made to them.

Early in the night dishes of wild herbs and seeds, such as formed the food of the Navahoes in the old days, before they became farmers and herders, are brought in, sung over and eaten by those who choose to partake.

The love-feast comes later. This consists of cold cornmeal gruel, or thin mush, prepared in

a water-tight wicker bowl with many ceremonial observances. The bowl is passed around sunwise and everybody helps himself with his fingers to four morsels. But before the men partake, the gods are fed—a morsel of gruel is laid on the mouth of each mask. After the gruel is finished all partake of pollen.

About midnight the ceremony of waking the gods begins. Although the Navahoes do not use time-pieces, this act occurs always almost exactly at midnight. The shaman sings a long song, the burden of which is Hyidezná (he stirs, he moves); a different god is mentioned in each stanza. When the singer mentions the name of a god he lifts the appropriate mask and shakes it in tune to the song. The last prayer occurs after dawn, the vigil ends, and the lodge is prepared for the work of the fifth day.

The paper closed by giving the reasons for certain Navaho symbolisms, especially that which assigns the north to the male and the south to the female.

The closing paper on *Racial Anatomical Peculiarities* was read by Dr. D. K. Shute.

George R. Stetson,
Recording Secretary.

NEW YORK ACADEMY OF SCIENCES.

In the absence of the President the meeting was called to order by Prof. R. S. Woodward. The minutes were read and approved and Dr. Franz Boas, of the American Museum of Natural History was elected resident member. Twenty-six members and guests were present. Prof. M. I. Pupin then read before the Section of Astronomy and Physics a paper on the *Magnetic circuit.* In transformers, especially of closed iron core, it has long been known that the upper 'harmonics' of the fundamental rate of alternations present in the primary are choked out by the transformer leaving the potential difference of the secondary coil represented by a simple sine curve. The choking out is less if the magnetic circuit is incomplete, and least when the coils have no magnetic core. Various explanations have been offered to account for this phenomenon; it is doubtless true that it is due to Foucault currents and to hysteresis. Dr. Pupin pointed out from certain mathematical considerations that by appropriate measurements, especially of the angle of lag, it would be possible to separate the energy consumed in Foucault currents from that consumed by hysteresis, and thus be able to study this latter puzzling phenomenon. Investigations are in progress to test the method experimentally. Prof. Crocker remarked upon the interest and importance of the questions involved.

The second paper was by Dr. A. A. Julien upon 'The condensed gas film on the surface of solid bodies with relation to (1) Newton's rings of the first order; (2) sand flotation; (3) sand in harmonic vibration.

Owing to the lateness of the hour Dr. Julien passed over the first two heads, giving an outline of the literature of the question of liquid films on solids. He then outlined his experiments in sonorizing sands artificially, and demonstrating the necessity of an antecedent water film before the sand becomes sonorous. It must also be of approximately uniform size of grain. The paper was discussed by Profs. Mayer, Van Nardroff, Pupin and Hallock. At 10:30 the meeting adjourned.

W. Hallock,
Secretary of Section.

GEOLOGICAL CONFERENCE OF HARVARD UNIVERSITY, DECEMBER 17, 1895.

The Geology of the Woonsocket Basin. (Preliminary Report.) By F. C. Schrader.

The basin consists of a local widening in the normally trenchant valley of the Blackstone River where the river traverses a narrow belt of soft rocks. The outline of the basin is roughly that of the cross-section of a plano-convex lens, whose straight edge, representing the southeast side of the basin, extends from Primrose, south of Woonsocket Hill, in Rhode Island, ten miles northeastward to South Bellingham, in Massachusetts. The convex edge includes near its middle point Blackstone village on the northwest, whence the Blackstone river, like a vertical let fall to the opposite side just below the city of Woonsocket, bisects the basin, whose width is here about three miles.

The rocks in the basin are eroded to a depth of two hundred or more feet below the upland or old baselevel of the surrounding country. Some bed-rock hills are, however, still prominent

within the basin, and the deposits of glacial drift, chiefly water-laid, frequently approach a hundred feet in thickness.

The rocks enclosing the basin are mainly gneisses, hornblende granites, and, on the west, some quartzites. Excepting a few of the granites, they are all Pre-Carboniferous and extend over wide areas of country. They have a southeast-northwest trend, and the gneisses and quartzites dip to the northeast, as seen in the Manville section and at Woonsocket Hill. Compared to the rocks within the basin, they are hard and form good resisters to weathering. To this difference of resistance to weathering between the extra- and the intra-basin rocks, the basin doubtless mainly owes its present topography.

The rocks within the basin are soft, have a southwest-northeast trend, and dip northwest. They are much younger than the enclosing rocks, with which they exhibit marked unconformities, as with the quartzites on the west and the gneisses on the north. The lowest and apparently oldest of these rocks, but of unknown age, is a uniformly very fine grained, grey, talcose, silicious mica-schist, which in the past has been worked with profit in the whetstone industry. It occurs chiefly in the southeast side of the basin. Above this grey rock, but unconformable with it, in the west part of the basin, is found a shiny black hornblende mica-schist, also of questionable age; while unconformably over both the grey and the black lie the youngest rocks in the basin. These latter, though as yet they have yielded no fossils, are probably Carboniferous, judging from their geological relations and lithologic resemblance to the well-known Carboniferous on the east, in the Narragansett Basin. They consist of grey conglomerates with interbedded mica-schists, sandstones and slates. They are derived chiefly from the surrounding older rocks of the upland, as is manifest by the granite and quartzite pebbles contained in the conglomerates, occurring east of Forestdale and at Woonsocket Hill.

Cutting the rocks in the basin at intervals is a series of diabase dikes. They range from less than one to more than a hundred feet in width, dip about vertical, and run nearly parallel, bearing north-northeast.

Preliminary Report on the Stamford Gneiss: By W. H. SNYDER.

In the southwestern part of Vermont and extending into the northwestern part of Massachusetts there occurs a coarse banded gneiss covering about 50 square miles and called by the U. S. Geological Survey the Stamford Gneiss. It was known in Pres. Hitchcock's survey of Vermont as the Stamford Granite.

This gneiss is surrounded on the east and south by a metamorphosed conglomerate, the pebbles of which correspond to the blue quartz of the gneiss. At a short distance from the contact the conglomerate changes into a micaceous quartzite. In this quartzite there has been found by Walcott trilobites which prove it to be Cambrian. On the west the gneiss appears to be bounded by a very massive white quartzite, the dip and strike of which mostly correspond to that of the micaceous quartzite on the east. The northern boundary is as yet undetermined.

At the contact of the conglomerate and gneiss there is developed between the two a layer of about a foot in thickness in which the gneissic structure is particularly pronounced, the mica making lenticular folds around the quartz grains and giving the mass the appearance of augen-gneiss. Prof. Pumpelly has suggested that this layer is the disintegrated border of the gneiss upon which the conglomerate was laid down and which has since been metamorphosed.

The gneiss itself is composed of coarse feldspar crystals, irregular masses of blue quartz and thin layers of a greenish mica. In some parts there are large Carlsbad twins of microcline and in others rounded masses of feldspar 3 and 4 inches in diameter. At one point the weathering has developed nodular feldspar aggregates as large as a hen's egg, which give the face of the ledge a conglomeratic appearance. The rocks yield easily to weathering throughout the area. There are no glacial striæ apparent upon any exposed surface.

Near the western border of the gneiss there is an outcrop of a fine grained greenish gneiss very distinct from that of the main mass and surrounded on three sides by this mass. The fourth side is hidden by a bog. The Stamford gneiss apparently overlies this gneiss and

sends apophyses into it. The contact between the two is distinctly marked, and although a careful microscopical examination has not as yet been made, it does not appear to be a metamorphic contact due to stretching, but an igneous contact, the Stamford gneiss having covered, when in a melted condition, the green gneiss. The Stamford gneiss is apparently a granite which has had the gneissic character impressed upon it.

The general occurrence, composition and structure of the Stamford gneiss corresponds very closely with the Rapakiwi granite of Finnland, described by J. J. Sederholm in Tschermak's Mineralogische und Petrographische Mittheilungen, Band XII., pages 1–31, 1891. Ueber die Finnländischen Rapakiwigesteine.

DECEMBER 10, 1895.

Preliminary Notes on the North Jersey Coast. J. Edmund Woodman.

Three important causes of change are now in operation here—submergence, recession and advance. The first is widespread, but immeasurable. The evidence relevant to this is varied, but chiefly the presence of stumps in salt and brackish water. Deepening of inlets affords no criterion.

Recession is effected by (1) waves, and (2) currents. On Sandy Hook and south of Manasquan inlet this is replaced by advance or grade; hence these are nodal points. This recession is measurable, and may be prophesied approximately for any specified time within certain limits. It can be temporarily prevented at isolated points, although not by present methods, but its ultimate conquest is sure.

The waves act (1) by eroding the shore; (2) by damming inlets, and (3) by transporting material off shore to form bars. Erosion is irregular, and in places erosion and advance alternate and partially compensate. Cutting is greatest with a northeast wind—*i. e.*, when wind and current are in opposition; it is least with a southeast wind. This is contrary to general theory, but is readily explainable. The damming of inlets is caused partly by coastwise bars raised by the waves and partly by sediment from the streams falling in the dead water where current and waves meet. Probably the former cause does not operate until some sedimentation has taken place. Most of the sand eroded from the shore is carried a few hundred feet out to form bars, little migrating along the margin of the land.

The currents act (1) by carrying a small amount of sand along shore as mentioned; (2) by the migration of bars northward—the most important method of transportation, and, as a result, (3) by deposition of most or all the sand on Sandy Hook.

T. A. Jaggar, Jr.,
Recording Secretary.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

At the meeting of January 6, 1896, President Green in the chair and eighteen other members present, the officers placed in nomination at the last meeting were declared as elected for the year 1896.

The reports for 1895 of the Treasurer and Librarian were read and accepted.

Prof. Engler pointed out a simple graphical method of drawing a normal to a parabola from a point outside the curve.

On motion of Prof. Pritchett, the Council was requested to arrange for a meeting of the Academy, in the near future, commemorative of the service of four distinguished men who had died in the past year: Dana, Helmholtz, Huxley and Pasteur.

Mr. Espenschied exhibited several samples of sisal and palm-fibre utensils obtained from the Bermudas and West Indies, explaining the mode of preparation.

Two new resident members were elected.

Wm. Trelease,
Recording Secretary.

NEW BOOKS.

Movement. E. J. Marey. New York, D. Appleton & Co. 1895. Pp. xv + 318. $1.75.

Computation Rules and Logarithms. Silas W. Holman. New York and London, Macmillan & Co. 1896. Pp. xlv + 73. $1.00.

Plant Breeding. L. H. Bailey. New York and London, Macmillan & Co. 1895. Pp. vii + 293. $1.00.

The Chemistry of Pottery. Karl Langenbeck. Chemical Publishing Co., Easton, Pa. Pp. vi + 197.